(19) Europäisches Patentamt
European Patent Office
Office européen des brevets

(11) **EP 2 441 312 B1**

(12) **EUROPEAN PATENT SPECIFICATION**

(45) Date of publication and mention of the grant of the patent:
23.10.2019 Bulletin 2019/43

(21) Application number: **10725566.3**

(22) Date of filing: **10.06.2010**

(51) Int Cl.:
H04W 4/38 *(2018.01)* ***A61B 5/00*** *(2006.01)*
H04W 88/04 *(2009.01)* ***G16H 10/65*** *(2018.01)*
G16H 40/20 *(2018.01)*

(86) International application number:
PCT/US2010/038198

(87) International publication number:
WO 2010/144720 (16.12.2010 Gazette 2010/50)

(54) IDENTIFICATION AND CONNECTIVITY GATEWAY WRISTBAND FOR HOSPITAL AND MEDICAL APPLICATIONS

INDENTIFIKATIONS- UND KONNEKTIVITÄTSGATEWAY-ARMBAND ZUR ANWENDUNG IN KRANKENHÄUSERN UND IN DER MEDIZIN

BRACELET D'IDENTIFICATION ET DE PASSERELLE DE CONNECTIVITÉ POUR APPLICATIONS HOSPITALIÈRES ET MÉDICALES

(84) Designated Contracting States:
AL AT BE BG CH CY CZ DE DK EE ES FI FR GB GR HR HU IE IS IT LI LT LU LV MC MK MT NL NO PL PT RO SE SI SK SM TR

(30) Priority: **10.06.2009 US 482175**

(43) Date of publication of application:
18.04.2012 Bulletin 2012/16

(73) Proprietor: **QUALCOMM Incorporated**
San Diego, CA 92121 (US)

(72) Inventor: **TEAGUE, Edward, Harrison**
San Diego
California 92121 (US)

(74) Representative: **Wegner, Hans**
Bardehle Pagenberg Partnerschaft mbB
Patentanwälte, Rechtsanwälte
Prinzregentenplatz 7
81675 München (DE)

(56) References cited:
WO-A2-2006/102537 **WO-A2-2008/014432**
US-A1- 2006 238 333 **US-A1- 2009 030 967**

- **"3rd Generation Partnership Project; Technical Specification Group Services and System Aspects; Security related network functions (Release 1999)", 3GPP STANDARD; 3GPP TS 03.20, 3RD GENERATION PARTNERSHIP PROJECT (3GPP), MOBILE COMPETENCE CENTRE ; 650, ROUTE DES LUCIOLES ; F-06921 SOPHIA-ANTIPOLIS CEDEX ; FRANCE, no. V8.6.0, 1 December 2007 (2007-12-01), pages 1-95, XP050357826,**

EP 2 441 312 B1

Description

FIELD OF THE INVENTION

[0001] The present invention relates generally to computer network communications, and more specifically to methods and devices for identifying patients and relaying medical sensor data to hospital computer networks.

BACKGROUND

[0002] Medical facilities like hospitals face many challenges, including accurately tracking patients and the medications administered to them. Typically, patients are provided with a plastic wristband when they are admitted to a medical facility which includes their identifying information, such as name and a hospital record identifier. Procedures for tracking patients and administering medications involve numerous checks of each patient's wristband by nurses and doctors throughout the day. While generally effective, this manual inspection of wristbands can be inefficient and is prone to human error.

[0003] Another challenge facing hospitals involves the integration of new medical sensor technology and the associated volume of medical sensor data with patients' medical records and the hospital's information system infrastructure. With the continued miniaturization of electronic components it is anticipated that the medical industry will deploy ever smaller electronic medical sensors which can be placed on or within a patient to record and report any of variety of medically important parameters. Current methods for connecting medical sensors to patients use wires and cables stretching between the sensor on the patient and a monitoring system positioned nearby. As a result, a typical critical care patient may be attached to dozens of wires and tubes leading to medical monitoring systems. The resulting tangle of leads and tubes can interfere with the care provided to patients and lead to potential hazards.

[0004] US 2009/030967 A1 discloses an integrated system which includes a microserver integrated with a movable platform and in communication with one or more data collection apparatus disposed about a living organism, and means for enabling two-way communications with the server from a remote location. The server hosts a webpage that is remotely accessible by the means for enabling two-way communications and capable of monitoring, retrieving, storing, analyzing and sending a set of data about the living organism from and to the server and one or more data collection apparatus.

[0005] US2006238333 A1 discloses personal status physiologic monitoring, comprising producing a continuous physiologic signal, as detected by a monitoring device; associating at least one unique hardware identifier to said continuous physiologic signal and binding a unique patient identifier to said continuous signal.

SUMMARY

[0006] The invention is defined in the independent claims. The various embodiments provide convenient solutions for identifying patients and linking miniaturized electronic medical sensors to a hospital information system infrastructure. A patient identifier wristband contains a wireless communication gateway device, which is referred to herein as a "gateway wristband." The gateway wristband is configured to store and wirelessly report a patient identifier (ID) to the hospital information system infrastructure, such as a network server. The patient ID may be an identifier that is specifically assigned to the patient or may be an identifier assigned to the gateway wristband ("wristband ID") that can be linked to the patient in a data file stored in the hospital information system infrastructure, such as a patient record database.

[0007] The gateway wristband may serve as a wireless gateway for a wireless personal area network (PAN) of miniaturized electronic medical sensors applied to the patient via a first transceiver ("PAN transceiver"). The gateway wristband may also serves as a communication node on a wireless local-area network (WLAN) or wireless wide-area network (WWAN) such as the hospital wireless network via a second transceiver (WLAN or WWAN transceiver). The gateway wristband may also include a memory for storing the patient or device ID, and a processor which controls the PAN and WLAN transceivers. The processor may be configured with software instructions to receive data via the PAN transceiver and relay received data along with the patient or wristband ID to an external network via the WLAN transceiver. The processor may be further configured to manage communications with both the personal area network and the wireless wide-area network, store received sensor data when necessary, and translate received data from the PAN protocol format to the WLAN or WWAN protocol format so that data can be reliably relayed from the sensors to the hospital's information system infrastructure. The processor may further be configured to implement communication security measures in communications with both the personal area and local-area networks as may be necessary to protect patient data and ensure system reliability. The gateway wristband may also include an internal power source with the electronics sealed within a waterproof housing so that it is compatible with the hospital environment. In an embodiment, the gateway wristband may also or alternatively include a cellular telephone transceiver configured to establish a cellular data communication link so that the gateway wristband can relay received data to a hospital network via a cellular telephone network.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] The accompanying drawings, which are incorporated herein and constitute part of this specification, illustrate exemplary embodiments of the invention, and

together with the general description given above and the detailed description given below, serve to explain the features of the invention.

FIG. 1 is a communication system block diagram of a communication network which includes a gateway wristband linking medical sensors on a patient to a hospital wireless communication network according to an embodiment.

FIG. 2 is a communication system block diagram of a communication network which includes a gateway wristband linking medical sensors to a hospital communication network and the Internet according to an embodiment.

FIG. 3A is a message flow diagram of communications between a gateway wristband and a hospital network according to an embodiment.

FIG. 3B is a message flow diagram of communications between a gateway wristband and a hospital network according to another embodiment.

FIG. 3C is a message flow diagram of communications between a gateway wristband and a mobile device according to an embodiment.

FIG. 4 is a message flow diagram of communications between a gateway wristband and a wireless medical sensor according to an embodiment.

FIG. 5 is a message flow diagram of communications within the system illustrated in FIG. 1.

FIG. 6 is a process flow diagram of an embodiment method for relaying patient ID and medical sensor data to a hospital network.

FIG. 7 is a process flow diagram of an embodiment method for relaying patient ID and medical sensor data to a mobile computing device.

FIG. 8 is a communication system block diagram of a communication network which includes a gateway wristband linking wireless medical sensors on a patient to a hospital communication network via a cellular telephone communication link according to an embodiment.

FIG. 9 is a message flow diagram of communications within the system illustrated in FIG. 8.

FIG. 10 is a process flow diagram of an embodiment method suitable for use with the communication system illustrated in FIG. 8.

FIG. 11 is a component block diagram of a gateway wristband according to an example embodiment.

FIG. 12 is a component block diagram of an example wireless medical sensor suitable for use with the gateway wristband illustrated in FIG. 11.

FIG. 13 is a circuit block diagram of an example mobile computing device suitable for use with the gateway wristband illustrated in FIG. 11.

DETAILED DESCRIPTION

[0009] The various embodiments will be described in detail with reference to the accompanying drawings. Wherever possible, the same reference numbers will be used throughout the drawings to refer to the same or like parts. References made to particular examples and implementations are for illustrative purposes, and are not intended to limit the scope of the invention or the claims.

[0010] The word "exemplary" is used herein to mean "serving as an example, instance, or illustration." Any implementation described herein as "exemplary" is not necessarily to be construed as preferred or advantageous over other implementations.

[0011] As used herein, the terms "mobile computing device" and "handheld device" refer to any one or all of cellular telephones, personal data assistants (PDA's), palm-top computers, wireless electronic mail receivers and cellular telephone receivers (e.g., the Blackberry® and Treo® devices), multimedia Internet enabled cellular telephones (e.g., the Blackberry Storm®), and similar personal electronic devices which include a programmable processor and memory, a wireless communication transceiver.

[0012] Tracking patients and ensuring that correct medications are administered to them remains a persistent challenge in the medical industry. The most common method for identifying patients involves labeling them with a patient identification (ID) wristband when they are admitted. Typical patient ID wristbands are plastic strips printed with patient identifying information (e.g., name and/or ID number). Some patient ID wristbands include a barcode which can be read using a conventional barcode reader. The most common approach for ensuring patients receive proper medications involves comparing the patient ID information on the wristband with patient ID information associated with the medication. In automated facilities, a barcode reader may be used to read the barcode on the patient ID wristband and on barcodes attached to medicines or food trays. Such manual checking of patient IDs may be repeated several times a day as part of hospital procedures to reduce the chance of medical mistakes.

[0013] With the continued miniaturization of electronic components it is anticipated that the medical industry will soon deploy miniaturized electronic medical sensors which can be placed on or within a patient to record and report any of variety of medically important parameters.

In order to reduce the clutter and confusion in the hospital environment, such miniaturized electronic medical sensors may be made wireless thereby obviating the need for wires connecting them to a data collection unit. To keep the size and power requirements of miniaturized electronic medical sensors to a minimum, such sensor devices are likely to use low-power wireless data links. A number of low power wireless data link protocols are available which are suitable for such purposes. Due to the limited range of such low-power wireless transceivers such communication links are often referred to as "personal area networks" (PAN), which is the term used herein to refer to networks which encompass a particular patient. A PAN transceiver typically has the range of a few feet and thus encompasses the area around a person but does not extend much further, and thus does not interfere or interact with other wireless networks. While such short range communication protocols provide convenient and energy-efficient communication links, such protocols are generally incompatible with wireless wide-area networks due to their limited range as well as incompatible waveforms and information encoding schemes.

[0014] Wireless local-area networks (WLAN) are widely deployed as part of the network infrastructure of institutions, such as hospitals, due to their ease of use and high data transmission rates. Examples of wireless local-area communication network protocols including IEEE 802.11 (WiFi), and WiMax. Institutions may also employ wireless wide-area networks (WWAN) which may use communication technologies providing wide area coverage, such as cellular networks like CDMA2000 and UMTS.

[0015] The incompatibilities between the WLAN or WWAN infrastructure of most hospital facilities and personal area networks that are likely to be used with miniaturized electronic medical sensors could limit the adoption of new medical technologies unless a solution to this problem is provided. In order for miniaturized electronic medical sensors to be effectively deployed in a hospital environment, a communication interface or gateway must be provided to relay sensor data from sensor networks to the institution's wireless wide-area network infrastructure.

[0016] The various embodiments resolve both problems of identifying patients and linking miniaturized electronic medical sensors to hospital wireless wide area networks with a wristband wireless communication gateway device ("gateway wristband"). The gateway wristband serves as a wireless gateway for both the personal area network (PAN) comprising miniaturized electronic medical sensors on or within a particular patient and a wireless local-area network (WLAN) such as a hospital's wireless network. Such a gateway wristband includes a PAN communication transceiver which can establish a wireless data link with short range (i.e., PAN protocol) transceivers, a WLAN communication transceiver which can establish a wireless data link with local and wide-area wireless transceivers, a memory which stores a unique identifier for the patient or the wristband, and a processor which can receive data via the PAN transceiver and relay the received data and the patient or wristband ID to an external network via the WLAN transceiver. The processor is configured with software instructions to manage communications with both the personal area network and the wireless wide-area network, store received sensor data when necessary, and translate data from the PAN protocol format to the WLAN protocol format so that data can be reliably relayed from the sensors to the hospital infrastructure. The processor may further be configured to implement communication security measures in communications with both the personal area and wide-area networks as may be necessary to protect patient data and ensure system reliability. The gateway wristband may also include an internal power source and be sealed within a waterproof housing so that it is compatible with the hospital environment.

[0017] The PAN transceiver is not necessarily limited to any particular protocol, and instead may encompass any relatively short range or limited area wireless communication link. Using proximity-limited communication links help to simplify the system architecture by reducing the potential that the gateway wristband will detect and try to establish communication links with miniaturized electronic medical sensors on another patient. Examples of PAN protocols which may be used in the various embodiments include Bluetooth®, IEEE 802.15.4, and Zigbee® wireless communication protocols and standards. In addition to these PAN protocols, wireless proximity-limited communication links may be established using other close range communication media, including for example radiofrequency identification (RFID) tag and the IrDA (Infrared Data Association) protocols. Also, other close range wireless protocols and standards may be developed and may be used in the various embodiments in the same manner as described herein. Further, longer range wireless communication protocols may be used with modifications or additions to limit their effective range to the vicinity of the patient's gateway wristband. For example, WiFi and WiMax wireless communication protocols could also be used in combination with range-limiting features. For example, the power of the miniaturized electronic medical sensor transmitters may be limited. As another example, round-trip communication delay limits may be imposed such that the sensor-gateway wristband communication links can only be established if the round trip of such signals is less than a threshold set to reject signals sent from more than a dozen feet or so, which may be as short as two to three feet separation.

[0018] The various embodiments may implement known fundamental communication security mechanisms such as device-to-device pairing, encrypted data links, integrity checking, and establishing a trust domain. As used herein, the term "trust domain" refers to a set of devices in possession of common or related credentials such that the devices can "trust" each other to share con-

fidential information and exchange communications in a secure manner. An example of a trust domain is a pair (or more) of devices sharing a set of X0.509 certificates signed by a Certificate Authority, e.g., a PKI. Another example of a trust domain is a pair (or more) of devices sharing symmetric credentials. To extend a trust domain to another device, the receiving device needs to be verified as a valid new member, and the credentials need to be exchanged securely.

[0019] In a further embodiment, the gateway wristband may also include a close range communication (e.g., near field communication) transceiver for exchanging information useful for establishing secure communication links, such as exchanging network set up information, security credentials and encryption keys. References herein to "close range communication links" (CRCL) and "near field communications" (NFC) refer to links with a communication range limited to less than about one foot, and in some embodiments to approximately 0-20 cm (up to 8 in.).

[0020] Typical PAN protocols provide for automatic exchanging of link establishment information. Thus, in an embodiment the gateway wristband may automatically detect and establish data communication links with miniaturized electronic medical sensors within range. For example, the gateway wristband and a miniaturized electronic medical sensor may exchange address and device identifier information (e.g., sensor ID or MAC ID) necessary to enable establishing a BlueTooth® wireless data link with no further synchronization activity or user action. As another example, the two devices may exchange Internet Protocol (IP) or local area network address information to enable communications with WiFi wireless or Ethernet-based networks.

[0021] FIG. 1 shows typical elements of a communication system including a gateway wristband 1 on a patient's wrist. The Gateway wristband 1 includes an internal PAN transceiver for establishing communication links 10 with a plurality of miniaturized electronic medical sensors 2a-2d, and a WLAN transceiver for establishing wide-area wireless communications links 12 with a base station 5 of a hospital network 4. The gateway wristband 1 may also establish communication links 12 with mobile computing devices such as a PDA 3 which may be carried by a physician or nurse. As described more fully below with reference to FIG. 11, the gateway wristband 1 includes one or more processors and memory which enable the device to receive sensor data from the miniaturized electronic medical sensors 2a-2d in a first communication protocol, such as PAN communication links 10, temporarily store the data if necessary, and relay the data to an external network in a second communication protocol, such as WLAN communication links 12 to a hospital network 4. Thus, the gateway wristband 1 serves as a communication interface gateway receiving data from a first network (e.g., a PAN network of miniaturized electronic medical sensors 2a-2d) in a first protocol and relaying it to a second network (e.g., the hospital network 4) in a second protocol.

[0022] In addition to acting as a communication gateway, the processor within the gateway wristband 1 is configured with software instructions to communicate a patient ID or a wristband ID (which is linked to the patient in a data table maintained within the hospital information system) to the hospital network 4 and/or to mobile computing devices, such as a nurse's PDA 3. The patient or wristband ID may be communicated to the hospital network 4 periodically so as to indicate the location of the patient within the network, as may be indicated by the particular base station 5 in communication with the gateway wristband 1. The patient or wristband ID may be communicated to a PDA 3 when the devices come in close proximity or when an operator (e.g., a nurse or doctor) presses a key to identify the patient. In this manner the gateway wristband 1 can help ensure that medications are given to patients accurately. Also, the patient or wristband ID may be communicated as part of the communication of sensor data so that the hospital network 4 can accurately correlate the received medical sensor data with the particular patient to whom it corresponds. As a further patient identification aid, the gateway wristband 1 may be imprinted with the patient's name, an ID number, and/or barcode which may be read in the same manner that conventional patient wristbands are reviewed today.

[0023] By providing a communication interface gateway, the gateway wristband 1 facilitates the use of miniaturized electronic medical sensors 2a-2d on patients by receiving data from the low-power sensor devices and relaying the data to the hospital network at a higher power and in a data format consistent with the hospital's WLAN system. As such, the gateway wristband 1 eliminates many of the wires and cumbersome devices that would otherwise be required to couple a patient's miniaturized electronic medical sensors 2a-2d to recording devices or the hospital network 4.

[0024] The communication links provided by the gateway wristband 1 may also enable connecting the patient and the patient's miniaturized electronic medical sensors to a wider area network, such as the Internet 24 as illustrated in FIG. 2. This communication network includes a gateway wristband 1 including a WLAN or WWAN transceiver for transmitting and receiving data network signals 12 from/to a WLAN or WWAN base station antenna 5. In this example network the base station antenna 5 is coupled to the hospital network 4 which includes elements required to operate a wireless network, such as a plurality of wireless routers 18, coupled to elements required to operate a wired network, such as a router 19 and a network server 22, all of which may be couple by wired connections 14. Other computers 30 and monitors may be coupled to the hospital network 4 via wired connections 14 or wireless connections 12 via the base station antenna 5.

[0025] As is typical today, the hospital network 4 may be coupled to an external network such as the Internet

24. In a typical embodiment, a hospital network server 22 is coupled to the Internet 24 via an internet connection (not shown). In turn, other computers, such a laptop computer 30, can be coupled to the hospital network 4 via the Internet 24 by way of their own Internet connection 28. In a further embodiment, one or more servers 26 may be coupled to the Internet 24 and configured to receive data relayed by the gateway wristband 1, such as to be stored within a patient's electronic medial records maintained on the server 26.

[0026] As described above, the gateway wristband 1 includes a PAN transceiver that is configured to establish wireless personal area network connections with one or more miniaturized electronic medial sensors 2a-2d via PAN communication links 10. The gateway wristband 1 is configured to receive data from the miniaturized electronic medial sensors 2a-2d via the PAN communication links 10 and relay the data to the hospital network 4 via WLAN or WWAN communication links 12. Additionally, some mobile computing devices, such as a laptop 30, may also be configured with both a PAN transceiver, to receive data from miniaturized electronic medical sensors 2a-2d, and with a WLAN or WWAN transceiver to establish network communication links 12 with the hospital network 4 via a base station antenna 5.

[0027] The gateway wristband 1 may be configured to automatically establish wireless communications with a hospital network 4 or mobile computing device, such as a PDA 3. An example of messages that may be exchanged between a gateway wristband 1 and a hospital work 4 are illustrated in FIG. 3A. When the gateway wristband 1 senses a wireless wide-area network it may initiate link establishment handshaking messages 30 with that network. Such handshaking messages are determined by the particular communication protocol implemented by the WLAN or WWAN network and may be transmitted over the same WLAN or WWAN communication link as subsequent data communications. Once a communication link has been established, the gateway wristband 1 and the hospital network 4 may exchange registration messages 32 as necessary to correlate the gateway wristband 1 with the patient and the patient with the hospital network 4. For example, when a gateway wristband 1 is first placed on the wrist of the patient as part of a patient admission procedure, the gateway wristband 1 and hospital network 4 may exchange the registration messages 32 to enable the hospital network 4 to record the patient ID or wristband ID within a patient registry database. Once the patient registration process has been completed, subsequent communications may only transmit the patient ID or wristband ID to enable the hospital network 4 to identify the patient and correlate received sensor data with that particular patient. Once the network communication links are established and the patient and/or wristband have been registered with hospital network 4, the hospital network may periodically request the patient ID or patient data, optional query message 34. Such a message may be addressed to the gateway wristband 1 and include a command instruction that the processor within the gateway wristband 1 can properly interpret. In response to receiving a patient ID or data query message 34 from the hospital network 4, the gateway wristband 1 may transmit the patient ID or wristband ID to the hospital network 4, message 36. The gateway wristband 1 then may began transmitting sensor data to the hospital network 4, messages 38.

[0028] In an embodiment, the gateway wristband 1 may include a CRCL transceiver configured to establish a CRCL communication link with a terminal on the hospital network 4 for purposes of conducting the registration procedure. Messages exchanged in this embodiment are illustrated in FIG. 3B. In this embodiment the process of registering the gateway wristband 1 with the hospital network 4 involves bringing the wristband into close proximity with a CRCL transceiver on the terminal within the hospital network 4. As soon as the gateway wristband 1 is within communication range of the CRCL transceiver on the hospital network 4 link establishment handshaking messages 40 will begin in order to establish a CRCL communication link. Once the CRCL communication link has been established, the gateway wristband 1 may transmit information identifying it to the hospital network 4 such as a wristband ID or similar credential message 42. The hospital network 4 may use the wristband ID or credentials to verify that the gateway wristband 1 is an authorized device, and if so the hospital network 4 may transmit patient ID or other credentials associated with the patient to the gateway wristband 1 for storage in memory, message 44. Since the patient ID and other patient information are necessarily private information, transmitting this information over a CRCL communication link provides inherent security due to its very short range. The gateway wristband 1 may save the patient ID or other information in memory for use in communicating the patient ID to the hospital network 4 or mobile computing devices 3. Once the registration information messages have been exchanged over the CRCL network, the gateway wristband 1 may be placed on the patient and moved outside the communication range of the hospital network CRCL terminal, thus ending the CRCL communication link. At this point, the gateway wristband 1 may automatically establish a WLAN or WWAN communication link with the hospital network 4 by exchanging link establishment handshaking messages 30 as described above with reference to FIG. 3A. Once the wireless communication link is established with the hospital network 4, the gateway wristband 1 may transmit the patient ID, message 36, and sensor data, message 38, as described above with reference to FIG. 3A.

[0029] The registration process described above need not be limited to a CRCL communication link, and instead may be accomplished using a personal area network (PAN) (i.e., an intermediate range network communication link) as noted in FIG. 3B. In this embodiment, the hospital network 4 may include a terminal configured with a PAN transceiver. When the gateway wristband 1 is

brought within range of that network PAN transceiver, the link establishment handshaking messages 40 may be exchanged. Once that PAN communication link is established, the wristband ID or credentials may be transmitted to the hospital network 4 over the PAN communication link. Similarly, the hospital network 4 may transmit patient ID or other information to the gateway wristband 1 via that same PAN communications link, message 44. In order to avoid inadvertently establishing PAN communication links between the gateway wristband 1 and the hospital network 4, such a PAN transceiver may be limited to one or a few terminals that are removed from the patient treatment areas. For example, hospital network PAN transceivers may be included in terminals located only in areas where patients are admitted to the hospital (i.e., where gateway wristbands 1 are attached to patients).

[0030] In a similar manner, the gateway wristband 1 may establish communications with a mobile computing device, such as a PDA 3. Messages that may be exchanged between the gateway wristband 1 and a mobile computing device 3 are illustrated in FIG. 3C. When the gateway wristband 1 detects signals from a transceiver within the mobile computing device 3, the gateway wristband 1 may began exchanging link establishment handshaking messages 50 with the mobile computing device 3. Once the communication link is established, the mobile computing device 3 may transmit a patient ID or data query request message 52. In response to receiving the patient ID or data query request message 52, the gateway wristband 1 may transmit the patient or wristband ID, message 54, and then transmit sensor data, message 56. The patient ID or data query request message 52 is optional as the gateway wristband 1 may be configured to automatically transmit the patient or wristband ID and sensor data (message 56) to the mobile computing device 3 whenever a communications link is established between the two devices.

[0031] Communications between the gateway wristband 1 and miniaturized electronic medical sensors 2 are illustrated in FIG. 4. When the gateway wristband 1 senses signals from miniaturized electronic medical sensors 2 it may initiate link establishment handshaking messages 60 in order to establish a PAN communication link. These link establishment handshaking messages 60 will be transmitted over the PAN communication link according to the implemented communication protocol. Once a PAN communication link is established, the medical sensors 2 may transmit a sensor ID, message 62, thereby identifying the particular sensor to the gateway wristband 1. Transmitting a sensor ID allows the gateway wristband 1 to receive data from several different sensors, with the data identified or correlated to each sensor ID. This process may continue until communication links are established with all of the miniaturized electronic medical sensors 2 attached on or within the patient. The gateway wristband 1 may query the miniaturized electronic medical sensors 2 by sending a sensor data query message 64 to each sensor. This sensor data query message 64 is optional because the medical sensors may be configured to transmit their data periodically without the need for queries. Periodically or in response to receiving a sensor data query message 64, each miniaturized electronic medical sensor 2 will transmit its sensor data to the gateway wristband 1, message 66. These data transmissions will be repeated for all of the sensors within the PAN network, and may continue over time as the sensors periodically report their data. Optionally, the gateway wristband 1 may periodically start another series of sensor data transmissions (message 66) by transmitting a sensor data query message 64.

[0032] FIG. 5 illustrates the messages that may be exchanged between miniaturized electronic medical sensors, gateway wristbands 1, and hospital networks 4 or mobile computing devices 3. As discussed above, the gateway wristband 1 may register with the hospital network 4 by exchanging link establishment messages (messages 30) and exchanging wristband and patient registration information (messages 32). Once registered with the hospital network 4, the gateway wristband 1 may establish communication links with each of the miniaturized electronic medical sensors 2 on a patient by exchanging link establishment handshaking messages 60. The gateway wristband 1 receives the sensor IDs (message 62), and receives the sensor data (message 66) which may be accomplished in response to a sensor data query message 64. If the gateway wristband 1 receives a patient ID or data query message 34 from the hospital network 4 or a mobile computing device 3, it may transmit the wristband or patient ID, message 36. The gateway wristband 1 may also transmit sensor data that it has received, message 38. When the gateway wristband 1 senses a communication link from a mobile computing device 3, it may establish a wireless communication link with that device by exchanging link establishment handshaking messages 50. The mobile computing device 3 may request the patient ID and/or data by transmitting an ID and/or data query message 52. In response, the gateway wristband 1 may transmit the patient or wristband ID, message 54, and transmit sensor data, message 56.

[0033] An example of operations that may be implemented with the various embodiments is illustrated in the process flow shown in FIG. 6. As mentioned above, when the gateway wristband 1 senses a wireless network, it may exchange messages sufficient to log the gateway wristband 1 into the network, step 100. The gateway wristband 1 may then detect sensors within range of its personal area network and established communication links with each, step 102. Once all the personal area network communication links are established, the medical sensors and the gateway wristband 1 may begin monitoring the patient, step 104. When the gateway wristband 1 receives sensor data, step 106, it may determine whether the hospital network 4 is available, determination 108. If a communication link is established with the hospital

network (i.e., determination 108 = "Yes"), it may transmit the patient ID to the network, step 110, and transmit the sensor data, step 112. Once all of the data is transmitted, the gateway wristband 1 may return to the processes of receiving sensor data, step 106. However, if there is no communication link with the hospital network 4 (i.e., determination 108 = "No"), a processor within the gateway wristband 1 may store the sensor data in memory, step 114. The gateway wristband 1 may also periodically attempt to login to the network, step 116. When the sensor data is stored in memory (step 114), the gateway wristband 1 may return to the step of receiving sensor data, step 106.

[0034] Example operations that may be performed by the gateway wristband 1 in communicating with a mobile computing device are illustrated in the process flow diagram shown in FIG. 7. As discussed above, the gateway wristband 1 may detect medical sensors within its personal area network range and establish communications with each, step 102. With those personal area network communication links established the gateway wristband 1 may begin the process of monitoring the patient, step 104, including receiving sensor data, step 106, and storing such a data in memory, step 114. This process may continue until a mobile computing device 3 comes within communication range of the gateway wristband 1. When the gateway wristband 1 senses a network signal from a mobile computing device 3, it may negotiate the wristband-to-mobile computing device communication link, step 120. Once that communication link is established, the gateway wristband 1 may log itself into the mobile computing device, step 122, and transmit the patient or wristband ID, step 124. Once the gateway wristband 1 has identified the patient to the mobile computing device 3, it may begin transmitting the sensor data stored within its memory to the mobile computing device 3, step 126.

[0035] The gateway wristband 1 may also be configured with a cellular telephone transceiver to enabling connecting the patient and the patient's miniaturized electronic medical sensors to a hospital or other communication network via a cellular data communication network. By way of example, FIG. 8 shows a block diagram of a communication network including a cellular network in which the gateway wristband 1 includes a cellular telephone transceiver for connecting to a cellular network that includes a base station (BS) 92 coupled to a mobile switching center (MSC) 94. In operation, the MSC 94 is capable of routing data calls to and from the gateway wristband 1 via the base station 92 via a cellular wireless communication link 90 when a cellular data call is established. The MSC may be coupled to a server gateway 96 coupled to the Internet 24 so that patient data can be relayed to a hospital network 4 or a medical practitioner's personal computer (not shown). As described above with reference to FIG. 2, the hospital network 4 may include a network router 19 coupled to a server 22 and a plurality of computers or monitors 28.

[0036] In the embodiment illustrated in FIG. 8, the gateway wristband 1 is configured to collect and store patient data from miniaturized electronic medical sensors 2a-2d and periodically dial a telephone number to establish a cellular data call (communication link 90) to download the data to a server, such as a server 22 within a hospital network 4. This embodiment may enable patients who must be continuously monitored to return home or move to facilities outside the confines of the hospital network 4. Since the gateway wristband 1 is unobtrusive and configured with software to perform the communications, data storage and data relay functions autonomously, this embodiment should remove many of the burdens associated with remote patient monitoring.

[0037] Messages that may be exchanged in the communication network illustrated in FIG. 8 are illustrated in FIG. 9. As described above, the gateway wristband 1 establishes communication links with each of the miniaturized electronic medical sensors 2 within range of its personal area network, such as by exchanging link establishment handshaking messages 60 and receiving sensor IDs, messages 62. The gateway wristband 1 may periodically query the sensors by sending sensor data query messages 64. In response, the miniaturized electronic medical sensors 2 may transmit their data to the gateway wristband 1 (messages 66) which saves the data in memory. Periodically, such as daily, hourly, or some other frequency, the gateway wristband 1 may place a data call to a cellular network, message 70. The messages and steps required to establish the data call to a network server 22 via a cellular network are consistent with those implemented in standard cellular communication systems. Once a data communication link to a network server 22 is established via the cellular network, the gateway wristband 1 may exchange messages and transmit data necessary to register itself with the server, messages 72. Since patient data is subject to HIPA security requirements, the gateway wristband 1 and the server 22 may negotiate an encrypted communication like by exchanging messages 74. The establishment of such an encrypted data communication link may use protocols that are well-known for such purposes. Once an encrypted communication link is established, the hospital network server 22 may request the patient ID or patient data, optional message 76. This patient ID and/or data query message 76 is optional as the gateway wristband 1 may be configured to automatically transmit such information upon establishing a communication link with the server 22. The gateway wristband 1 may then transmit the patient or wristband ID to the hospital network server, message 78, and communicate the stored sensor data, messages 80. While the data call is established, the hospital network server may also transmit commands to the gateway wristband 1, message 82. Once all of the sensor data has been transmitted and instructions received, the hospital network server 22 or the gateway wristband 1 may terminate the data call.

[0038] Example operations which may be implemented in the network illustrated in FIG. 8 are illustrated in

the process flow diagram shown in FIG. 10. As described above, the gateway wristband 1 establishes communication links with each of the miniaturized electronic medical sensors 2 within range of its personal area network, such as by exchanging link establishment handshaking messages 60 and receiving sensor IDs, messages 62. The gateway wristband 1 may periodically query the sensors by sending sensor data query messages 64. In response, the miniaturized electronic medical sensors 2 may transmit their data in messages 66 which are received by the gateway wristband 1, step 106, and saved in memory, step 114. Periodically, the gateway wristband 1 processor may determine whether it is time to report data to the hospital network, determination 130. If it is not time to report data (i.e., determination 130= "No"), the process of receiving sensor data, step 106, and storing the sensor data in memory, step 114, may continue. When it is time to report data (i.e., determination 130 = "Yes"), the gateway wristband 1 activates its cellular network transceiver to place a data call to the network server 22 of a hospital network 4 (for example) and login to the network, step 132. As part of logging into the hospital network 4, the hospital network server 22 and the gateway wristband 1 may negotiate an encrypted communication link, step 134. With an encrypted communication link established, the gateway wristband 1 may transmit the patient or wristband ID to the network server 22, step 136. The gateway wristband 1 may then transmit the stored sensor data to the server 22, step 138. The network server 22 may also transmit commands to the gateway wristband 1, step 140, such as to change the reporting frequency or initiate/terminate monitoring of particular sensors. Once all data has been transmitted and all commands received and acknowledged the data call is terminated, step 142. At this point the gateway wristband 1 may return to receiving sensor data, step 106.

[0039] Example components that may be included in an exemplary gateway wristband 1 are illustrated in FIG. 11. In an embodiment, the gateway wristband 1 includes a communication interface gateway device 150 that is sealed within a water resistant wristband 14. In a preferred embodiment the water resistant wristband 14 is made of any plastic or rubber substance which is resistant to the sterilizing and cleaning solutions used in a medical facility. The communication interface gateway device 150 may include a processor 151 coupled to memory 152 and a power source, such as a battery 153. In an embodiment, the communication interface gateway device 150 may also include one or more light emitting diodes (LEDs) 154 which may be used to communicate operational status information. A WLAN or WWAN transceiver 155 may be coupled to the processor 151 and configured to establish WLAN or WWAN communication links 12 with a wireless network. A PAN transceiver 156 is also coupled to the processor 151 and configured to establish PAN communication links 10. The communication interface gateway device 150 may also include an induction charging circuit element 157 so that the battery 153 can be recharged by placing the gateway wristband 1 in close proximity to an induction charging system. Such an induction charging element 157 may include an induction coil 158 coupled to a rectifier circuit 159. When an alternating magnetic field is applied to the coil 158, alternating electrical currents are induced in the coil which are rectified by the rectifier circuit 159 to output a charging voltage. The charging voltage may be regulated by the processor 151 and used to charge the battery 153.

[0040] In the embodiment described above with reference to FIGs. 8-10, the gateway wristband 1 may include a cellular telephone transceiver as the WWAN transceiver 155. In an embodiment, the WLAN or WWAN transceiver 155 may be configured to communicate with either or both wireless local-area networks (e.g., WiFi) and cellular telephone wireless wide-area networks. In another embodiment, the gateway wristband 1 may include both a WLAN transceiver 155 and a cellular telephone transceiver which is not shown separately but would be represented in a similar manner in a component block diagram.

[0041] An example miniaturized electronic medical sensor 2 is illustrated in FIG. 12. A miniaturized electronic medical sensor 2 may include a processor 161 coupled to memory 162 and a power supply, such as a battery 163. The miniaturized electronic medical sensor 2 may include a PAN transceiver 165 coupled to the processor 6 and an antenna configured to establish personal area network-range wireless communications, such as using the BlueTooth® protocol. The miniaturized electronic medical sensor 2 may further include one or more medical sensors 164a-164d which may be any of a variety of the medical mechanical, electrical or chemical sensor that are well known in the medical arts.

[0042] The various embodiments may be used in conjunction with or communicate with a mobile computing device, such as a PDA 3 illustrated in FIG. 13. For example, mobile computing devices 3 may include a processor 171 coupled to internal memory 172 and a display 173, such as a liquid crystal display (LCD), all included within a case or housing 170. Additionally, the mobile computing device 3 may have an antenna 174 for sending and receiving electromagnetic radiation that is connected to a wireless data link transceiver 175 coupled to the processor 171. Such a WLAN wireless data link transceiver 175 may be configured according to any known wireless wide-area communication protocol, such as IEEE 802.11 or WiMax, in order to connect with a hospital wireless network 4. Mobile devices 3 may also include a second wireless transceiver, such as a PAN transceiver 178 coupled to the processor 171 and the antenna 174 to enable it to communicate with the gateway wristband 1 or with a patient's miniaturized electronic medical sensors 2. Mobile computing devices 3 also typically include a key pad 176 or miniature keyboard and menu selection buttons or rocker switches 177 which may serve as pointing devices for receiving user inputs for positioning a cursor within the display 173.

[0043] In the various devices, the processors 151, 161 and 171 may be any programmable microprocessor, microcomputer or multiple processor chip or chips that can be configured by software instructions to perform a variety of operations, including the operations of the various embodiments described above. In some devices, multiple processors 151, 161 and 171 may be provided, such as one processor dedicated to wireless communication functions and one processor dedicated to running other applications. Typically, software instructions may be stored in the internal memory 152, 162, 172 before they are accessed and loaded into the processor 151, 161, 171. In some devices, the processor 151, 161, 171 may include internal memory sufficient to store the software instructions. For the purposes of this description, the term memory refers to all memory accessible by the processor 171151, 161, 171, including connected memory units 152, 162, 172 and memory within the processor 151, 161, 171 itself. Sensor data will typically be stored in the memory unit 152, 162, 172. In many devices, the memory 152, 162, 172 may be a volatile or nonvolatile memory, such as flash memory, or a mixture of both.

[0044] Those of skill in the art would appreciate that the various illustrative logical blocks, modules, circuits, and algorithm steps described in connection with the aspects disclosed herein may be implemented as electronic hardware, computer software, or combinations of both. To clearly illustrate this interchangeability of hardware and software, various illustrative components, blocks, modules, circuits, and steps have been described above generally in terms of their functionality. Skilled artisans may implement the described functionality in varying ways for each particular application, but such implementation decisions should not be interpreted as causing a departure from the scope of the present invention.

[0045] In various embodiments the functions described above may be implemented in hardware, software, firmware, or any combination thereof. Whether such functionality is implemented as hardware or software depends upon the particular application and design constraints imposed on the overall system. If implemented in software, the functions may be stored or transmitted as one or more instructions or codes on a computer-readable medium. Computer-readable media include both computer storage media and communication media including any medium that facilitates transfer of a computer program from one place to another. A storage medium may be any available media that can be accessed by a computer. By way of example, and not limitation, such computer-readable media can comprise RAM, ROM, EEPROM, CD-ROM or other optical disk storage, magnetic disk storage or other magnetic storage devices, or any other medium that can be used to carry or store desired program code in the form of instructions or data structures and that can be accessed by a computer. Also, any connection is properly termed a computer-readable medium. For example, if the software is transmitted from a website, server, or other remote source using a coaxial cable, fiber optic cable, twisted pair, digital subscriber line (DSL), or wireless technologies such as infrared, radio, and microwave, then the coaxial cable, fiber optic cable, twisted pair, DSL, or wireless technologies such as infrared, radio, and microwave are included in the definition of medium. Disk and disc, as used herein, includes compact disc (CD), laser disc, optical disc, digital versatile disc (DVD), floppy disk and blu-ray disc where disks usually reproduce data magnetically, while discs reproduce data optically with lasers. Combinations of the above should also be included within the scope of computer-readable media.

[0046] The order in which the steps of a method described above and shown in the figures is for example purposes only as the order of some blocks may be changed from that described herein without departing from the scope of the present invention and the claims.

[0047] The steps of a method or algorithm described in connection with the aspects disclosed herein may be embodied directly in hardware, in a software module executed by a processor, or in a combination of the two. A software module may reside in processor readable memory which may be any of RAM memory, flash memory, ROM memory, EPROM memory, EEPROM memory, registers, hard disk, a removable disk, a CD-ROM, or any other form of storage medium known in the art. An exemplary storage medium is coupled to a processor such that the processor can read information from, and write information to, the storage medium. In the alternative, the storage medium may be integral to the processor. The processor and the storage medium may reside in an ASIC. The ASIC may reside in a user terminal or mobile device. In the alternative, the processor and the storage medium may reside as discrete components in a user terminal or mobile device. Additionally, in some aspects, the blocks and/or actions of a method or algorithm may reside as one or any combination or set of codes and/or instructions on a machine readable medium and/or computer readable medium, which may be incorporated into a computer program product.

[0048] In the following, further examples are described to facilitate the understanding of the invention:

1. A method for identifying patients and communicating medical sensor data, comprising:

receiving data from at least one medical sensor via a first transceiver communicating according to a first communication protocol;
communicating a patient identifier to an external network via a second transceiver communicating according to a second communication protocol; and
relaying the received data to the external network via the second transceiver.

2. The method of example 1, further comprising:

sensing the at least one medical sensor;
establishing a communication link between the at least one medical sensor and the first transceiver; and
receiving a sensor identifier via the first transceiver.

3. The method of example 1, further comprising:

sensing the external network; and
establishing a communication link between the external network and the second transceiver.

4. The method of example 1, further comprising:
storing the received data.

5. The method of example 3, further comprising:

establishing an encrypted communication link between the second transceiver and the external network,
wherein the patient identifier and the received data are transmitted via the encrypted communication link.

6. The method of example 1, wherein the patient identifier comprises an identifier assigned to the patient.

7. The method of example 1, wherein the patient identifier comprises a device identifier that is correlated to the patient in a data table stored in the external network.

8. The method of example 1, further comprising:

sensing an external wireless communication device;
establishing a communication link between the second transceiver and the external wireless communication device according to the second communication protocol;
communicating the patient identifier to the external wireless communication device via the second transceiver; and
relaying the received data to the external wireless communication device via the second transceiver.

9. A communication gateway wristband, comprising:

a wristband;
a processor sealed within the wristband;
a first wireless transceiver coupled to the processor, the first wireless transceiver configured to communicate according to a first protocol;
a second wireless transceiver coupled to the processor, the second wireless transceiver configured to communicate according to a second protocol; and
a memory coupled to the processor, the containing a patient identifier,
wherein the processor is configured with software instructions to perform steps comprising:

receiving data from at least one medical sensor via the first wireless transceiver;
communicating the patient identifier to an external network via the second wireless transceiver; and
relaying the received data to the external network via the second wireless transceiver.

10. The communication gateway wristband of example 9, wherein the processor is configured with software instructions to perform steps further comprising:

sensing the at least one medical sensor;
establishing a communication link between the at least one medical sensor and the first wireless transceiver; and
receiving a sensor identifier via the first wireless transceiver.

11. The communication gateway wristband of example 9, wherein the processor is configured with software instructions to perform steps further comprising:

sensing the external network; and
establishing a communication link between the external network and the second wireless transceiver.

12. The communication gateway wristband of example 9, wherein the processor is configured with software instructions to perform steps further comprising:
storing the received data in the memory.

13. The communication gateway wristband of example 11, wherein the processor is configured with software instructions to perform steps further comprising:

establishing an encrypted communication link between the second wireless transceiver and the external network,
wherein the patient identifier and the received data are transmitted via the encrypted communication link.

14. The communication gateway wristband of example 9, wherein the patient identifier stored in the

memory comprises an identifier assigned to the patient.

15. The communication gateway wristband of example 9, wherein the patient identifier comprises an identifier of the communication gateway wristband that is correlated to the patient in a data table stored in the external network.

16. The communication gateway wristband of example 9, further comprising:

a battery coupled to the processor; and
an induction charging circuit coupled to the processor.

17. The communication gateway wristband of example 9, wherein:

the processor, first and second transceivers and memory are sealed within the wristband in a waterproof manner; and
the wristband is configured to be resistant to sterilization and cleaning solutions used in hospital facilities.

18. The communication gateway wristband of example 9, wherein the processor is configured with software instructions to perform steps further comprising:

sensing an external wireless communication device;
establishing a communication link between the second transceiver and the external wireless communication device according to the second communication protocol;
communicating the patient identifier to the external wireless communication device via the second transceiver; and
relaying the received data to the external wireless communication device via the second transceiver.

19. A tangible storage medium having stored thereon processor-executable software instructions configured to cause a processor to perform steps comprising:

receiving data from at least one medical sensor via a first wireless transceiver communicating according to a first communication protocol;
communicating a patient identifier to an external network via a second wireless transceiver communicating according to a second communication protocol; and
relaying the received data to the external network via the second wireless transceiver.

20. The tangible storage medium of example 19, wherein the tangible storage medium has processor-executable software instructions configured to cause a processor to perform further steps comprising:

sensing the at least one medical sensor;
establishing a communication link between the at least one medical sensor and the first wireless transceiver; and
receiving a sensor identifier via the first wireless transceiver.

21. The tangible storage medium of example 19, wherein the tangible storage medium has processor-executable software instructions configured to cause a processor to perform further steps comprising:

sensing the external network; and
establishing a communication link between the external network and the second wireless transceiver.

22. The tangible storage medium of example 19, wherein the tangible storage medium has processor-executable software instructions configured to cause a processor to perform further steps comprising:
storing the received data in the memory.

23. The tangible storage medium of example 21, wherein the tangible storage medium has processor-executable software instructions configured to cause a processor to perform further steps comprising:

establishing an encrypted communication link between the second wireless transceiver and the external network,
wherein the patient identifier and the received data are transmitted via the encrypted communication link.

24. The tangible storage medium of example 19, wherein the patient identifier comprises an identifier assigned to the patient.

25. The tangible storage medium of example 19, wherein the patient identifier comprises a device identifier that is correlated to the patient in a data table stored in the external network.

26. The tangible storage medium of example 19, wherein the tangible storage medium has processor-executable software instructions configured to cause a processor to perform further steps comprising:

sensing an external wireless communication device;
establishing a communication link between the second transceiver and the external wireless

communication device according to the second communication protocol;
communicating the patient identifier to the external wireless communication device via the second transceiver; and
relaying the received data to the external wireless communication device via the second transceiver.

27. A communication gateway wristband, comprising:

means for receiving data from at least one medical sensor via a first communication protocol;
means for communicating a patient identifier to an external network via a second communication protocol; and
means for relaying the received data to the external network via the second communication protocol.

28. The communication gateway wristband of example 27, further comprising:

means for sensing the at least one medical sensor;
means for establishing a communication link with the at least one medical sensor using the first communication protocol; and
means for receiving a sensor identifier via the first communication protocol.

29. The communication gateway wristband of example 27, further comprising:

means for sensing the external network; and
means for establishing a communication link with the external network using the second communication protocol.

30. The communication gateway wristband of example 27, further comprising:
means for storing the received data.

31. The communication gateway wristband of example 29, further comprising:

means for establishing an encrypted communication link with the external network,
wherein the patient identifier and the received data are transmitted via the encrypted communication link.

32. The communication gateway wristband of example 27, wherein means for communicating a patient identifier to an external network via a second communication protocol comprises means for communicating a patient identifier assigned to the patient.

33. The communication gateway wristband of example 27, wherein means for communicating a patient identifier to an external network via a second communication protocol comprises means for communicating a device identifier that is correlated to the patient in a data table stored in the external network.

34. The communication gateway wristband of example 27, further comprising:

means for providing power; and
means for charging the means for providing power.

35. The communication gateway wristband of example 27, further comprising:

means for sensing an external wireless communication device;
means for establishing a communication link between the second transceiver and the external wireless communication device according to the second communication protocol;
means for communicating the patient identifier to the external wireless communication device via the second transceiver; and
means for relaying the received data to the external wireless communication device via the second transceiver.

36. A communication system, comprising:

a first wireless network configured to communicate via a first wireless communication protocol;
at least one miniaturized electronic medical sensor configured to communicate via a second wireless communication protocol; and
a communication gateway wristband, the communication gateway wristband comprising:

a wristband;
a processor sealed within the wristband;
a first wireless transceiver coupled to the processor, the first wireless transceiver configured to communicate according to the first communication protocol;
a second wireless transceiver coupled to the processor, the second wireless transceiver configured to communicate according to the second communication protocol; and
a memory coupled to the processor, the memory containing a patient identifier,
wherein the processor is configured with software instructions to perform steps comprising:

receiving data from the at least one min-

iaturized electronic medical sensor via the first wireless transceiver;
communicating the patient identifier to the first network via the second wireless transceiver; and
relaying the received data to the first network via the second wireless transceiver.

37. The communication system of example 36, further comprising:

an external wireless communication device,
wherein the processor is configured with software instructions to perform steps further comprising:

sensing the external wireless communication device;
establishing a communication link between the second transceiver and the external wireless communication device according to the second communication protocol;
communicating the patient identifier to the external wireless communication device via the second transceiver; and
relaying the received data to the external wireless communication device via the second transceiver.

Claims

1. A method, for use in a communication gateway wristband, for identifying a patient and communicating medical sensor data, comprising:

sensing at least one medical sensor (2a, 2b, 2c, 2d);
establishing a communication link between the at least one medical sensor (2a, 2b, 2c, 2d) and a first transceiver (156);
receiving a sensor identifier via the first transceiver (156) to identify the at least one medical sensor (2a, 2b, 2c, 2d);
receiving data from the at least one medical sensor (2a, 2b, 2c, 2d) via the first transceiver (156) communicating according to a first communication protocol, wherein the data received from the at least one medical sensor (2a, 2b, 2c, 2d) is correlated to the sensor identifier;
establishing an encrypted communication link between a second transceiver (155) and an external network;
communicating a patient identifier to the external network via the second transceiver (155) communicating according to a second communication protocol, wherein the patient identifier is linked to the patient in a patient record database; and
relaying the received data to the external network via the second transceiver, wherein the patient identifier and the received data are transmitted via the encrypted communication link.

2. The method of claim 1, further comprising:

sensing the external network; and
establishing a communication link between the external network and the second transceiver (155).

3. The method of claim 1, further comprising:
storing the received data.

4. The method of claim 1, wherein the patient identifier comprises an identifier assigned to the patient.

5. The method of claim 1, wherein the patient identifier comprises a device identifier that is correlated to the patient in a data table stored in the external network.

6. The method of claim 1, further comprising:

sensing an external wireless communication device (3);
establishing a communication link between the second transceiver (155) and the external wireless communication device (3) according to the second communication protocol;
communicating the patient identifier to the external wireless communication device via the second transceiver (155); and
relaying the received data to the external wireless communication device via the second transceiver (155).

7. A communication gateway wristband (1), comprising:

means for sensing at least one medical sensor (2a, 2b, 2c, 2d);
means for establishing a communication link with at least one medical sensor (2a, 2b, 2c, 2d) using a first transceiver; and means for receiving a sensor identifier via the first transceiver to identify the at least one medical sensor (2a, 2b, 2c, 2d) to the communication gateway wristband (1);
means for receiving data from at least one medical sensor (2a, 2b, 2c, 2d) via the first transceiver (156) communicating according to a first communication protocol, wherein the data received from the at least one medical sensor (2a, 2b, 2c, 2d) is correlated to the sensor identifier;
means for establishing an encrypted communi-

cation link between a second transceiver (155) and an external network;
means for communicating a patient identifier to the external network via the second transceiver (155) communicating according to a second communication protocol, wherein the patient identifier is linked to the patient in a patient record database; and
means for relaying the received data to the external network via the second transceiver, wherein the patient identifier and the received data are transmitted via the encrypted communication link.

8. The communication gateway wristband of claim 7, further comprising:

means for sensing the external network; and
means for establishing a communication link with the external network using the second communication protocol.

9. The communication gateway wristband of claim 7, further comprising:
means for storing the received data.

10. The communication gateway wristband of claim 7, comprising:

a wristband (1);
a processor sealed within the wristband (151);
a first wireless transceiver (156) coupled to the processor, the first wireless transceiver configured to communicate according to a first protocol;
a second wireless transceiver (155) coupled to the processor, the second wireless transceiver configured to communicate according to a second protocol; and
a memory (152) coupled to the processor, containing a patient identifier,
wherein the processor (151) is configured with software instructions to perform steps comprising:

receiving data from at least one medical sensor (2a, 2b, 2c, 2d) via the first wireless transceiver (156);
establishing an encrypted communication link between a second transceiver (155) and an external network;
communicating the patient identifier to an external network via the second wireless transceiver (155); and
relaying the received data to the external network via the second wireless transceiver (155), wherein the patient identifier and the received data are transmitted via the encrypted communication link.

11. A communication system, comprising:

a first wireless network configured to communicate via a first wireless communication protocol;
at least one miniaturized electronic medical sensor (2a, 2b, 2c, 2d) configured to communicate via a second wireless communication protocol; and
a communication gateway wristband, the communication gateway wristband comprising:

a wristband (1);
a processor (151) sealed within the wristband;
a first wireless transceiver (156) coupled to the processor (151), the first wireless transceiver (156) configured to communicate according to the first communication protocol;

a second wireless transceiver (155) coupled to the processor (151), the second wireless transceiver (155) configured to communicate according to the second communication protocol; and
a memory (152) coupled to the processor (151), the memory (152) containing a patient identifier, wherein the patient identifier is linked to a patient in a patient record database, wherein the processor (151) is configured with software instructions to perform steps comprising:

sensing the at least one miniaturized electronic medical sensor (2a, 2b, 2c, 2d);
establishing a communication link between the at least one miniaturized electronic medical sensor (2a, 2b, 2c, 2d) and the first wireless transceiver (156); and
receiving a sensor identifier via the first wireless transceiver (156) to identify the at least one miniaturized electronic medical sensor (2a, 2b, 2c, 2d) to the communication gateway wristband;
receiving data from the at least one miniaturized electronic medical sensor (2a, 2b, 2c, 2d) via the first wireless transceiver, wherein the data received from the at least one miniaturized electronic medical sensor (2a, 2b, 2c, 2d) is correlated to the sensor identifier;
establishing an encrypted commu-

nication link between the second transceiver (155) and a second wireless network;
communicating the patient identifier to the second network via the second wireless transceiver (155); and
relaying the received data to the second network via the second wireless transceiver (155), wherein the patient identifier and the received data are transmitted via the encrypted communication link.

12. A computer program product comprising program instructions which are computer-executable to implement the method of one of claims 1 to 6.

Patentansprüche

1. Verfahren zur Verwendung in einem Kommunikationsgateway-Armband zum Identifizieren eines Patienten und Kommunizieren medizinischer Sensordaten, umfassend:

Erfassen mindestens eines medizinischen Sensors (2a, 2b, 2c, 2d);
Herstellen einer Kommunikationsverbindung zwischen dem mindestens einen medizinischen Sensor (2a, 2b, 2c, 2d) und einem ersten Sende-Empfänger (156);
Empfangen einer Sensorkennung über den ersten Sende-Empfänger (156), um den mindestens einen medizinischen Sensor (2a, 2b, 2c, 2d) zu identifizieren;
Empfangen von Daten von dem mindestens einen medizinischen Sensor (2a, 2b, 2c, 2d) über den ersten Sende-Empfänger (156), der gemäß einem ersten Kommunikationsprotokoll kommuniziert, wobei die von dem mindestens einen medizinischen Sensor (2a, 2b, 2c, 2d) empfangenen Daten mit der Sensorkennung korreliert sind;
Herstellen einer verschlüsselten Kommunikationsverbindung zwischen einem zweiten Sende-Empfänger (155) und einem externen Netzwerk;
Kommunizieren einer Patientenkennung an das externe Netzwerk über den zweiten Sende-Empfänger (155), der gemäß einem zweiten Kommunikationsprotokoll kommuniziert, wobei die Patientenkennung mit dem Patienten in einer Patientenakten-Datenbank verknüpft ist; und
Weiterleiten der empfangenen Daten an das externe Netzwerk über den zweiten Sende-Empfänger, wobei die Patientenkennung und die empfangenen Daten über die verschlüsselte Kommunikationsverbindung übertragen werden.

2. Verfahren nach Anspruch 1, ferner umfassend:

Erfassen des externen Netzwerks; und
Herstellen einer Kommunikationsverbindung zwischen dem externen Netzwerk und dem zweiten Sende-Empfänger (155).

3. Verfahren nach Anspruch 1, ferner umfassend:

Speichern der empfangenen Daten.

4. Verfahren nach Anspruch 1, wobei die Patientenkennung eine dem Patienten zugeordnete Kennung umfasst.

5. Verfahren nach Anspruch 1, wobei die Patientenkennung eine Gerätekennung umfasst, die mit dem Patienten in einer Datentabelle, die im externen Netzwerk gespeichert ist, korreliert ist.

6. Verfahren nach Anspruch 1, ferner umfassend:

Erfassen einer externen drahtlosen Kommunikationsvorrichtung (3);
Herstellen einer Kommunikationsverbindung zwischen dem zweiten Sende-Empfänger (155) und der externen drahtlosen Kommunikationsvorrichtung (3) gemäß dem zweiten Kommunikationsprotokoll;
Kommunizieren der Patientenkennung an die externe drahtlose Kommunikationsvorrichtung über den zweiten Sende-Empfänger (155); und
Weiterleiten der empfangenen Daten an die externe drahtlose Kommunikationsvorrichtung über den zweiten Sende-Empfänger (155).

7. Kommunikationsgateway-Armband (1), umfassend:

Mittel zum Erfassen mindestens eines medizinischen Sensors (2a, 2b, 2c, 2c, 2d);
Mittel zum Herstellen einer Kommunikationsverbindung mit mindestens einem medizinischen Sensor (2a, 2b, 2c, 2d) unter Verwendung eines ersten Sende-Empfängers; und
Mittel zum Empfangen einer Sensorkennung über den ersten Sende-Empfänger, um den mindestens einen medizinischen Sensor (2a, 2b, 2c, 2d) an das Kommunikationsgateway-Armband (1) zu identifizieren;
Mittel zum Empfangen von Daten von mindestens einem medizinischen Sensor (2a, 2b, 2c, 2d) über den ersten Sende-Empfänger (156), der gemäß einem ersten Kommunikationsprotokoll kommuniziert, wobei die von dem mindestens einen medizinischen Sensor (2a, 2b, 2c,

2d) empfangenen Daten mit der Sensorkennung korreliert sind;
Mittel zum Aufbau einer verschlüsselten Kommunikationsverbindung zwischen einem zweiten Sende-Empfänger (155) und einem externen Netzwerk;
Mittel zum Kommunizieren einer Patientenkennung an das externe Netzwerk über den zweiten Sende-Empfänger (155), der gemäß einem zweiten Kommunikationsprotokoll kommuniziert, wobei die Patientenkennung mit dem Patienten in einer Patientenakten-Datenbank verbunden ist; und
Mittel zum Weiterleiten der empfangenen Daten an das externe Netzwerk über den zweiten Sende-Empfänger, wobei die Patientenkennung und die empfangenen Daten über die verschlüsselte Kommunikationsverbindung übertragen werden.

8. Kommunikationsgateway-Armband nach Anspruch 7, ferner umfassend:

Mittel zum Erfassen des externen Netzwerks; und
Mittel zum Herstellen einer Kommunikationsverbindung mit dem externen Netzwerk unter Verwendung des zweiten Kommunikationsprotokolls.

9. Kommunikationsgateway-Armband nach Anspruch 7, ferner umfassend:
Mittel zum Speichern der empfangenen Daten.

10. Kommunikationsgateway-Armband nach Anspruch 7, umfassend:

ein Armband (1);
einen Prozessor, der in dem Armband (151) versiegelt ist;
einen ersten drahtlosen Sende-Empfänger (156), der mit dem Prozessor gekoppelt ist, wobei der erste drahtlose Sende-Empfänger konfiguriert ist, um gemäß einem ersten Protokoll zu kommunizieren;
einen zweiten drahtlosen Sende-Empfänger (155), der mit dem Prozessor gekoppelt ist, wobei der zweite drahtlose Sende-Empfänger konfiguriert ist, um gemäß einem zweiten Protokoll zu kommunizieren; und
einen Speicher (152), der mit dem Prozessor gekoppelt ist und eine Patientenkennung enthält,
wobei der Prozessor (151) mit Softwareanweisungen konfiguriert ist, um Schritte auszuführen, die Folgendes umfassen:

Empfangen von Daten von mindestens einem medizinischen Sensor (2a, 2b, 2c, 2d) über den ersten drahtlosen Sende-Empfänger (156);
Herstellen einer verschlüsselten Kommunikationsverbindung zwischen einem zweiten Sende-Empfänger (155) und einem externen Netzwerk;
Übertragen der Patientenkennung an ein externes Netzwerk über den zweiten drahtlosen Sende-Empfänger (155); und
Weiterleiten der empfangenen Daten an das externe Netzwerk über den zweiten drahtlosen Sende-Empfänger (155), wobei die Patientenkennung und die empfangenen Daten über die verschlüsselte Kommunikationsverbindung übertragen werden.

11. Kommunikationssystem, umfassend:

ein erstes drahtloses Netzwerk, das konfiguriert ist, um über ein erstes drahtloses Kommunikationsprotokoll zu kommunizieren;
mindestens einen miniaturisierten elektronischen medizinischen Sensor (2a, 2b, 2c, 2d), der zur Kommunikation über ein zweites drahtloses Kommunikationsprotokoll konfiguriert ist; und
ein Kommunikationsgateway-Armband, wobei das Kommunikationsgateway-Armband umfasst:

ein Armband (1);
einen Prozessor (151), der innerhalb des Armbandes versiegelt ist;
einen ersten drahtlosen Sende-Empfänger (156), der mit dem Prozessor (151) gekoppelt ist, wobei der erste drahtlose Sende-Empfänger (156) konfiguriert ist, um gemäß dem ersten Kommunikationsprotokoll zu kommunizieren;

einen zweiten drahtlosen Sende-Empfänger (155), der mit dem Prozessor (151) gekoppelt ist, wobei der zweite drahtlose Sende-Empfänger (155) konfiguriert ist, um gemäß dem zweiten Kommunikationsprotokoll zu kommunizieren; und
einen Speicher (152), der mit dem Prozessor (151) gekoppelt ist, wobei der Speicher (152) eine Patientenkennung enthält, wobei die Patientenkennung mit einem Patienten in einer Patientenakten-Datenbank verbunden ist, wobei der Prozessor (151) mit Softwareanweisungen konfiguriert ist, um Schritte auszuführen, die Folgendes umfassen:

Erfassen des mindestens einen miniaturisierten elektronischen medizinischen Sensors (2a, 2b, 2c, 2d);
Herstellen einer Kommunikationsverbindung zwischen dem mindestens einen miniaturisierten elektronischen medizinischen Sensor (2a, 2b, 2c, 2d) und dem ersten drahtlosen Sende-Empfänger (156); und
Empfangen einer Sensorkennung über den ersten drahtlosen Sende-Empfänger (156), um den mindestens einen miniaturisierten elektronischen medizinischen Sensor (2a, 2b, 2c, 2d) an das Kommunikationsgateway-Armband zu identifizieren;
Empfangen von Daten von dem mindestens einen miniaturisierten elektronischen medizinischen Sensor (2a, 2b, 2c, 2d) über den ersten drahtlosen Sende-Empfänger, wobei die von dem mindestens einen miniaturisierten elektronischen medizinischen Sensor (2a, 2b, 2c, 2d) empfangenen Daten mit der Sensorkennung korreliert sind;
Herstellen einer verschlüsselten Kommunikationsverbindung zwischen dem zweiten Sende-Empfänger (155) und einem zweiten drahtlosen Netzwerk;
Kommunizieren der Patientenkennung an das zweite Netzwerk über den zweiten drahtlosen Sende-Empfänger (155); und
Weiterleiten der empfangenen Daten an das zweite Netzwerk über den zweiten drahtlosen Sende-Empfänger (155), wobei die Patientenkennung und die empfangenen Daten über die verschlüsselte Kommunikationsverbindung übertragen werden.

12. Computerprogrammprodukt, umfassend Programmanweisungen, die computerausführbar sind, um das Verfahren nach einem der Ansprüche 1 bis 6 zu implementieren.

Revendications

1. Un procédé, pour son utilisation dans un bracelet à passerelle de communication, pour identifier un patient et communiquer des données de capteur médical, comprenant :

la détection d'au moins un capteur médical (2a, 2b, 2c, 2d) ;
l'établissement d'une liaison de communication entre l'au moins un capteur médical (2a, 2b, 2c, 2d) et un premier émetteur-récepteur (156) ;
la réception d'un identifiant de capteur via le premier émetteur-récepteur (156) pour identifier l'au moins un capteur médical (2a, 2b, 2c, 2d) ;
la réception de données en provenance de l'au moins un capteur médical (2a, 2b, 2c, 2d) via le premier émetteur-récepteur (156) communiquant selon un premier protocole de communication, dans lequel les données reçues en provenance de l'au moins un capteur médical (2a, 2b, 2c, 2d) sont corrélées à l'identifiant de capteur ;
l'établissement d'une liaison de communication chiffrée entre un second émetteur-récepteur (155) et un réseau externe ;
la communication d'un identifiant de patient au réseau externe via le second émetteur-récepteur (155) communiquant selon un second protocole de communication, dans lequel l'identifiant de patient est lié au patient dans une base de données de dossiers de patient ; et
le relais des données reçues au réseau externe via le second émetteur-récepteur, dans lequel l'identifiant de patient et les données reçues sont transmis via la liaison de communication chiffrée.

2. Le procédé selon la revendication 1, comprenant en outre :

la détection du réseau externe ; et
l'établissement d'une liaison de communication entre le réseau externe et le second émetteur-récepteur (155).

3. Le procédé selon la revendication 1, comprenant en outre :
le stockage des données reçues.

4. Le procédé selon la revendication 1, dans lequel l'identifiant de patient comprend un identifiant attribué au patient.

5. Le procédé selon la revendication 1, dans lequel l'identifiant de patient comprend un identifiant de dispositif qui est corrélé au patient dans une table de données stockée dans le réseau externe.

6. Le procédé selon la revendication 1, comprenant en outre :

la détection d'un dispositif de communication sans fil externe (3) ;
l'établissement d'une liaison de communication entre le second émetteur-récepteur (155) et le dispositif de communication sans fil externe (3) selon le second protocole de communication ;
la communication de l'identifiant de patient au dispositif de communication sans fil externe via le second émetteur-récepteur (155) ; et
le relais des données reçues au dispositif de communication sans fil externe via le second émetteur-récepteur (155).

7. Un bracelet à passerelle de communication (1), comprenant :

un moyen pour détecter au moins un capteur médical (2a, 2b, 2c, 2d) ;
un moyen pour établir une liaison de communication avec au moins un capteur médical (2a, 2b, 2c, 2d) à l'aide d'un premier émetteur-récepteur ; et
un moyen pour recevoir un identifiant de capteur via le premier émetteur-récepteur pour identifier l'au moins un capteur médical (2a, 2b, 2c, 2d) pour le bracelet à passerelle de communication (1) ;
un moyen pour recevoir des données en provenance d'au moins un capteur médical (2a, 2b, 2c, 2d) via le premier émetteur-récepteur (156) communiquant selon un premier protocole de communication, dans lequel les données reçues en provenance de l'au moins un capteur médical (2a, 2b, 2c, 2d) sont corrélées à l'identifiant de capteur ;
un moyen pour établir une liaison de communication chiffrée entre un second émetteur-récepteur (155) et un réseau externe ;
un moyen pour communiquer un identifiant de patient au réseau externe via le second émetteur-récepteur (155) communiquant selon un second protocole de communication, dans lequel l'identifiant de patient est lié au patient dans une base de données de dossiers de patient ; et
un moyen pour relayer les données reçues au réseau externe via le second émetteur-récepteur, dans lequel l'identifiant de patient et les données reçues sont transmis via la liaison de communication chiffrée.

8. Le bracelet à passerelle de communication selon la revendication 7, comprenant en outre :

un moyen pour détecter le réseau externe ; et
un moyen pour établir une liaison de communication avec le réseau externe à l'aide du second protocole de communication.

9. Le bracelet à passerelle de communication selon la revendication 7, comprenant en outre :
un moyen pour stocker les données reçues.

10. Le bracelet à passerelle de communication selon la revendication 7, comprenant :

un bracelet (1) ;
un processeur scellé au sein du bracelet (151) ;
un premier émetteur-récepteur sans fil (156) couplé au processeur, le premier émetteur-récepteur sans fil étant configuré pour communiquer selon un premier protocole ;
un second émetteur-récepteur sans fil (155) couplé au processeur, le second émetteur-récepteur sans fil étant configuré pour communiquer selon un second protocole ; et
une mémoire (152) couplée au processeur, contenant un identifiant de patient,
dans lequel le processeur (151) est configuré avec des instructions logicielles pour réaliser des étapes comprenant :

la réception de données en provenance d'au moins un capteur médical (2a, 2b, 2c, 2d) via le premier émetteur-récepteur sans fil (156) ;
l'établissement d'une liaison de communication chiffrée entre un second émetteur-récepteur (155) et un réseau externe ;
la communication de l'identifiant de patient à un réseau externe via le second émetteur-récepteur sans fil (155) ;
et
le relais des données reçues au réseau externe via le second émetteur-récepteur sans fil (155), dans lequel l'identifiant de patient et les données reçues sont transmis via la liaison de communication chiffrée.

11. Un système de communication, comprenant :

un premier réseau sans fil configuré pour communiquer via un premier protocole de communication sans fil ;
au moins un capteur médical électronique miniaturisé (2a, 2b, 2c, 2d) configuré pour communiquer via un second protocole de communication sans fil ; et
un bracelet à passerelle de communication, le bracelet à passerelle de communication comprenant :

un bracelet (1) ;
un processeur (151) scellé au sein du bracelet ;
un premier émetteur-récepteur sans fil (156) couplé au processeur (151), le pre-

mier émetteur-récepteur sans fil (156) étant configuré pour communiquer selon le premier protocole de communication ;
un second émetteur-récepteur sans fil (155) couplé au processeur (151), le second émetteur-récepteur sans fil (155) étant configuré pour communiquer selon le second protocole de communication ; et
une mémoire (152) couplée au processeur (151), la mémoire (152) contenant un identifiant de patient, dans lequel l'identifiant de patient est lié au patient dans une base de données de dossiers de patient, dans lequel le processeur (151) est configuré avec des instructions logicielles pour réaliser des étapes comprenant :

la détection de l'au moins un capteur médical électronique miniaturisé (2a, 2b, 2c, 2d) ;
l'établissement d'une liaison de communication entre l'au moins un capteur médical électronique miniaturisé (2a, 2b, 2c, 2d) et le premier émetteur-récepteur sans fil (156) ; et
la réception d'un identifiant de capteur via le premier émetteur-récepteur sans fil (156) pour identifier l'au moins un capteur médical électronique miniaturisé (2a, 2b, 2c, 2d) au niveau du bracelet à passerelle de communication ;
la réception de données provenant de l'au moins un capteur médical électronique miniaturisé (2a, 2b, 2c, 2d) via le premier émetteur-récepteur sans fil, dans lequel les données reçues en provenance de l'au moins un capteur médical électronique miniaturisé (2a, 2b, 2c, 2d) sont corrélées à l'identifiant de capteur ;
l'établissement d'une liaison de communication chiffrée entre le second émetteur-récepteur (155) et un second réseau sans fil ;
la communication de l'identifiant de patient au second réseau via le second émetteur-récepteur sans fil (155) ; et
le relais des données reçues au second réseau via le second émetteur-récepteur sans fil (155), dans lequel l'identifiant de patient et les données reçues sont transmis via la liaison de communication chiffrée.

12. Un produit-programme d'ordinateur comprenant des instructions de programme qui sont exécutables par ordinateur pour implémenter le procédé selon l'une des revendications 1 à 6.

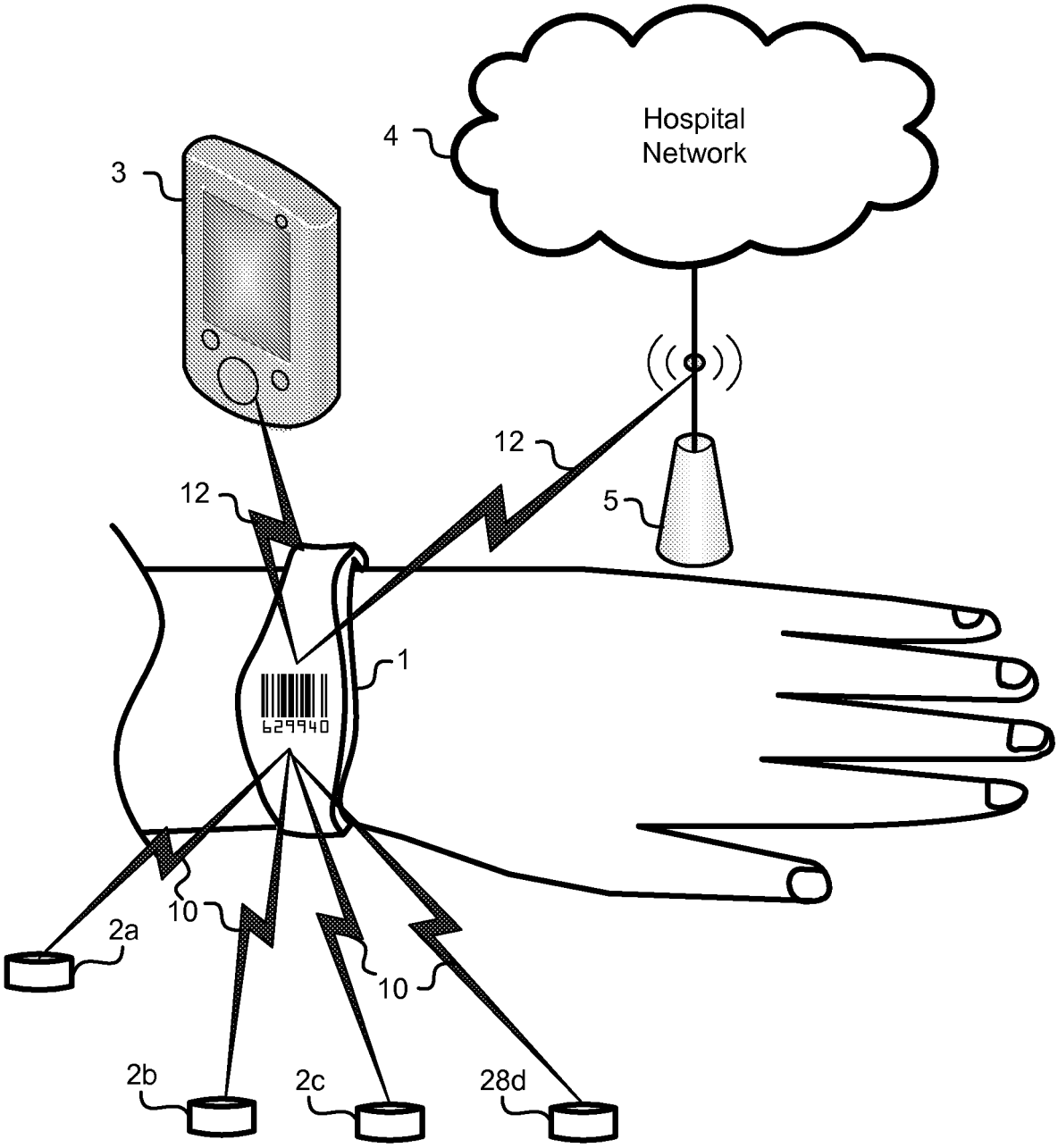

FIG. 1

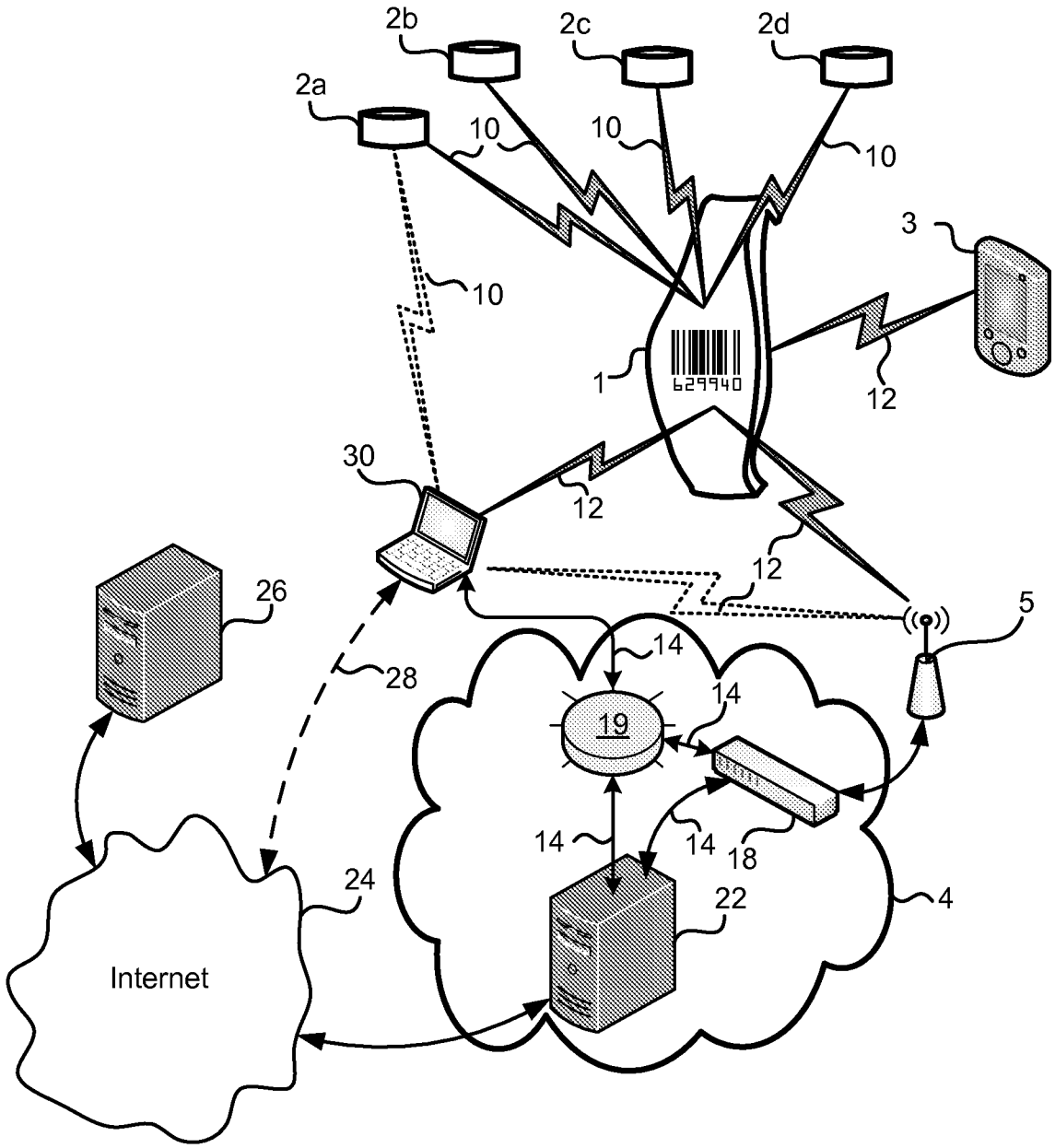
2b
2c
2d
2a
10
10
10
10
3
1
629940
12
30
12
12
26
28
5
14
19
14
14
14
18
24
22
4
Internet

FIG. 2

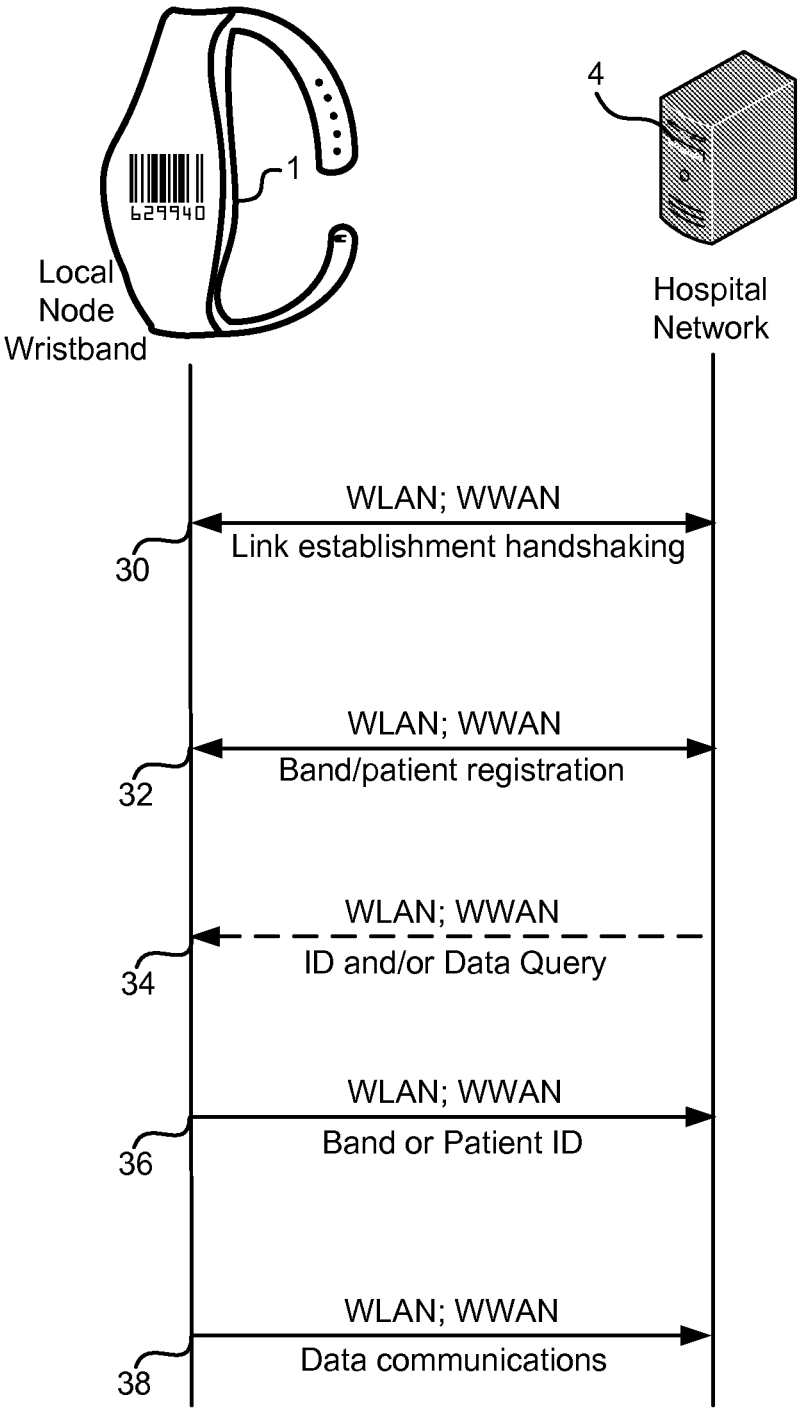
1
629940
Local
Node
Wristband
4
Hospital
Network
WLAN; WWAN
Link establishment handshaking
30
WLAN; WWAN
Band/patient registration
32
WLAN; WWAN
ID and/or Data Query
34
WLAN; WWAN
Band or Patient ID
36
WLAN; WWAN
Data communications
38

FIG. 3A

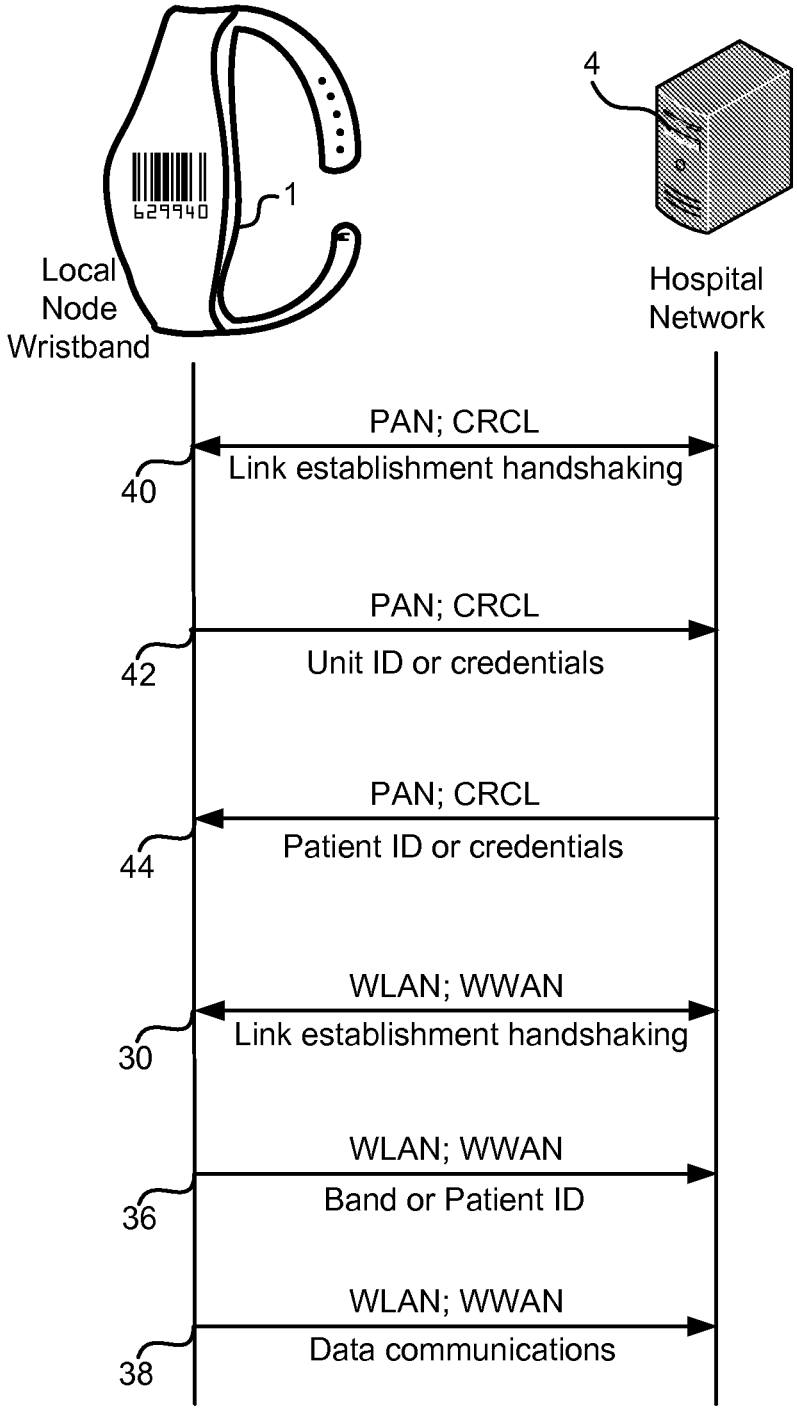
629940
1
Local
Node
Wristband
4
Hospital
Network
PAN; CRCL
Link establishment handshaking
40
PAN; CRCL
Unit ID or credentials
42
PAN; CRCL
Patient ID or credentials
44
WLAN; WWAN
Link establishment handshaking
30
WLAN; WWAN
Band or Patient ID
36
WLAN; WWAN
Data communications
38

FIG. 3B

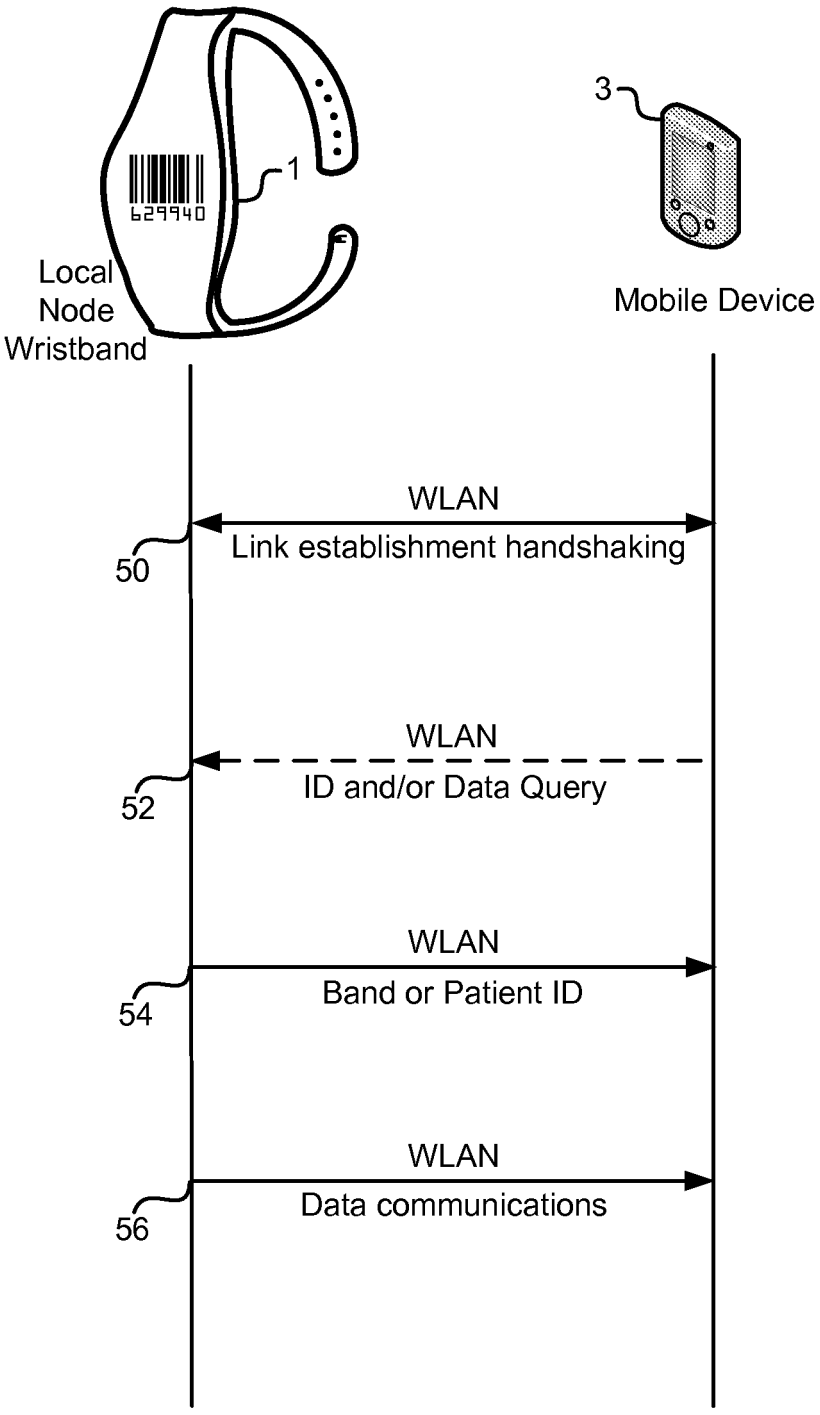
629940
1
Local
Node
Wristband
3
Mobile Device
WLAN
Link establishment handshaking
50
WLAN
ID and/or Data Query
52
WLAN
Band or Patient ID
54
WLAN
Data communications
56

FIG. 3C

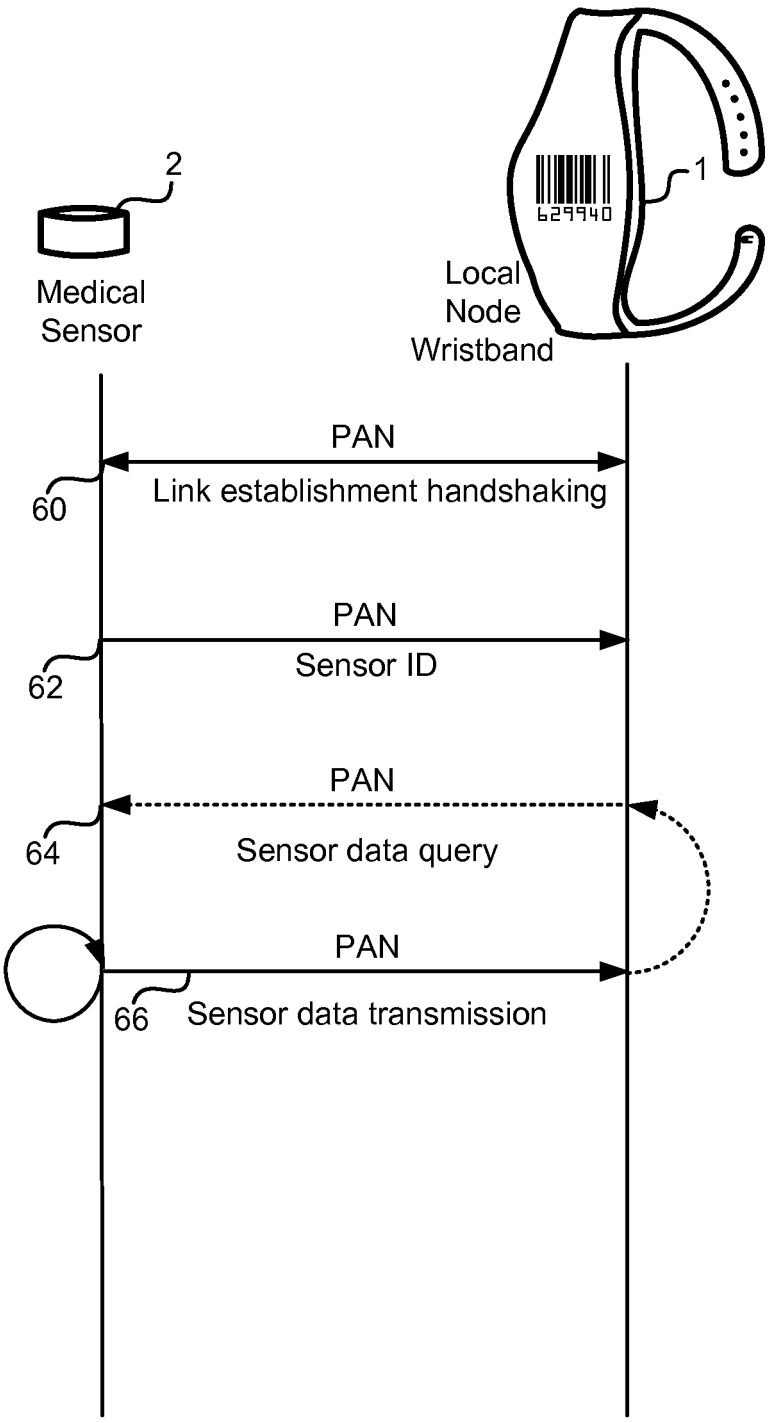
2
Medical Sensor
1
629940
Local Node Wristband
PAN
Link establishment handshaking
60
PAN
Sensor ID
62
PAN
Sensor data query
64
PAN
Sensor data transmission
66

FIG. 4

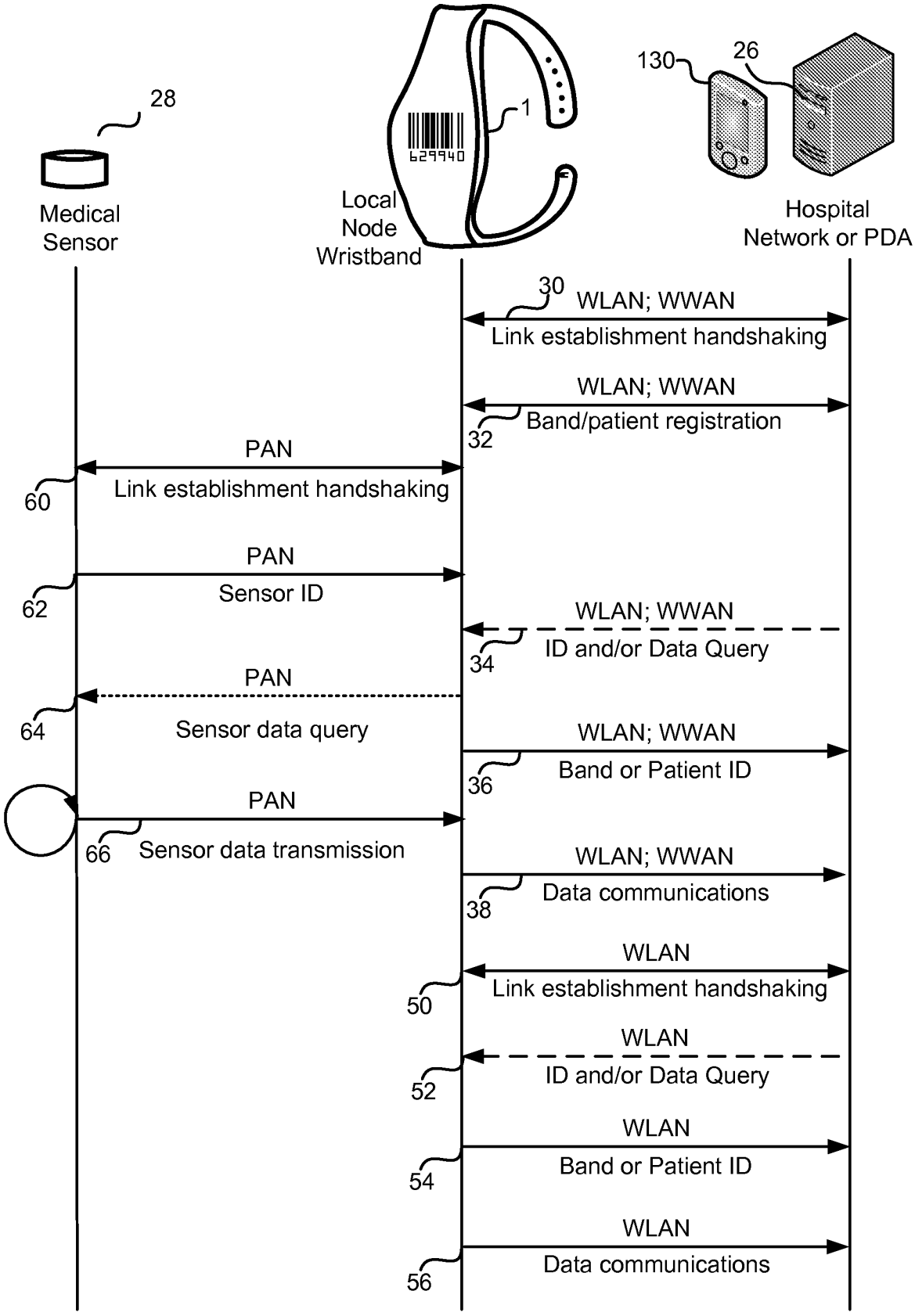
28
Medical Sensor
1
Local Node Wristband
130
26
Hospital Network or PDA
30
WLAN; WWAN
Link establishment handshaking
WLAN; WWAN
Band/patient registration
32
PAN
Link establishment handshaking
60
PAN
Sensor ID
62
WLAN; WWAN
ID and/or Data Query
34
PAN
Sensor data query
64
WLAN; WWAN
Band or Patient ID
36
PAN
66
Sensor data transmission
WLAN; WWAN
Data communications
38
WLAN
Link establishment handshaking
50
WLAN
ID and/or Data Query
52
WLAN
Band or Patient ID
54
WLAN
Data communications
56

FIG. 5

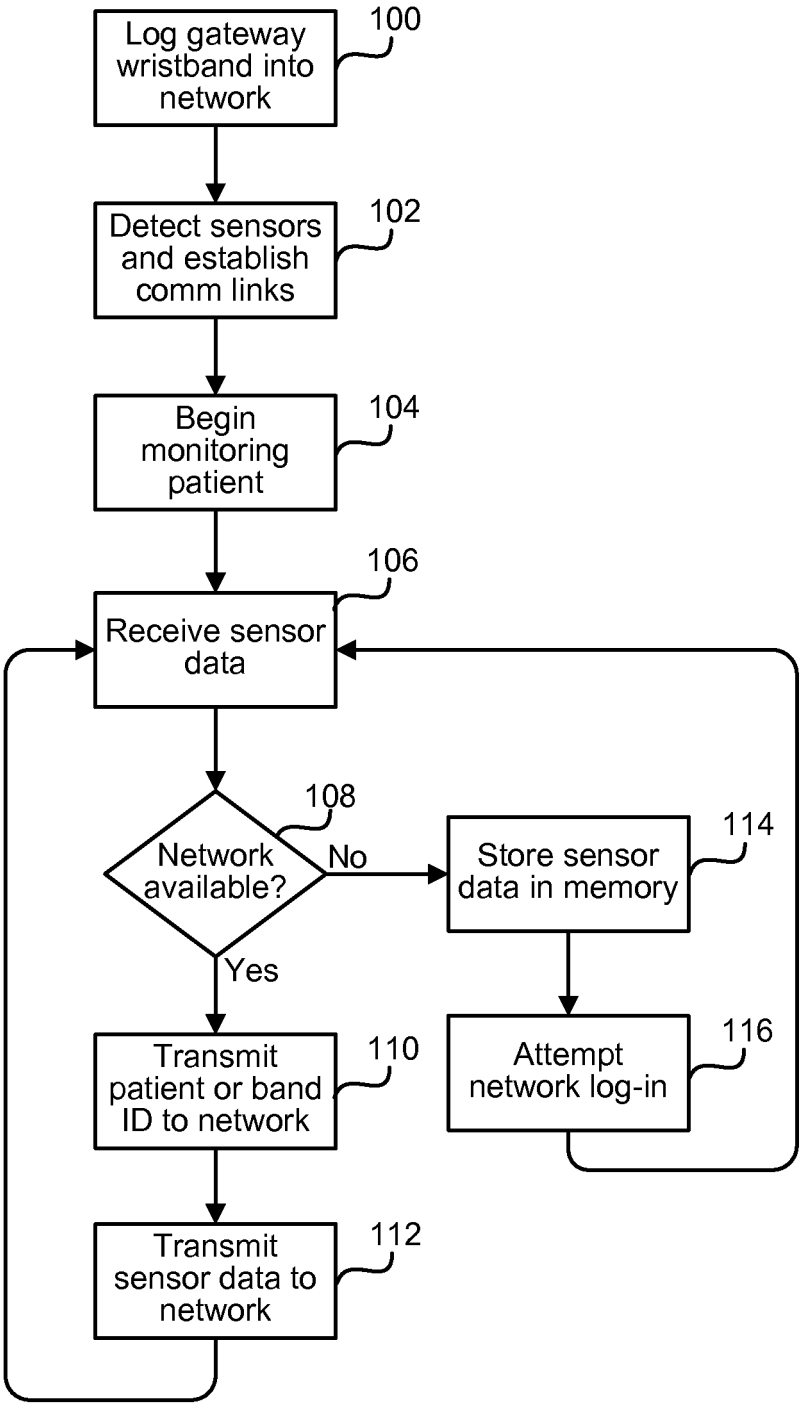
Log gateway wristband into network
100
Detect sensors and establish comm links
102
Begin monitoring patient
104
Receive sensor data
106
Network available?
108
No
Yes
Store sensor data in memory
114
Attempt network log-in
116
Transmit patient or band ID to network
110
Transmit sensor data to network
112

FIG. 6

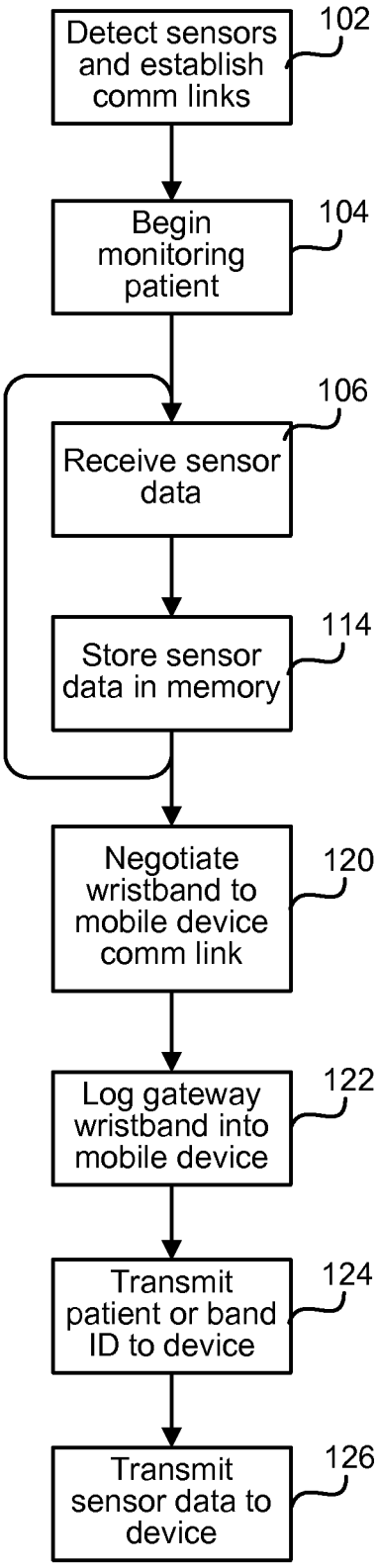
Detect sensors and establish comm links
102
Begin monitoring patient
104
Receive sensor data
106
Store sensor data in memory
114
Negotiate wristband to mobile device comm link
120
Log gateway wristband into mobile device
122
Transmit patient or band ID to device
124
Transmit sensor data to device
126

FIG. 7

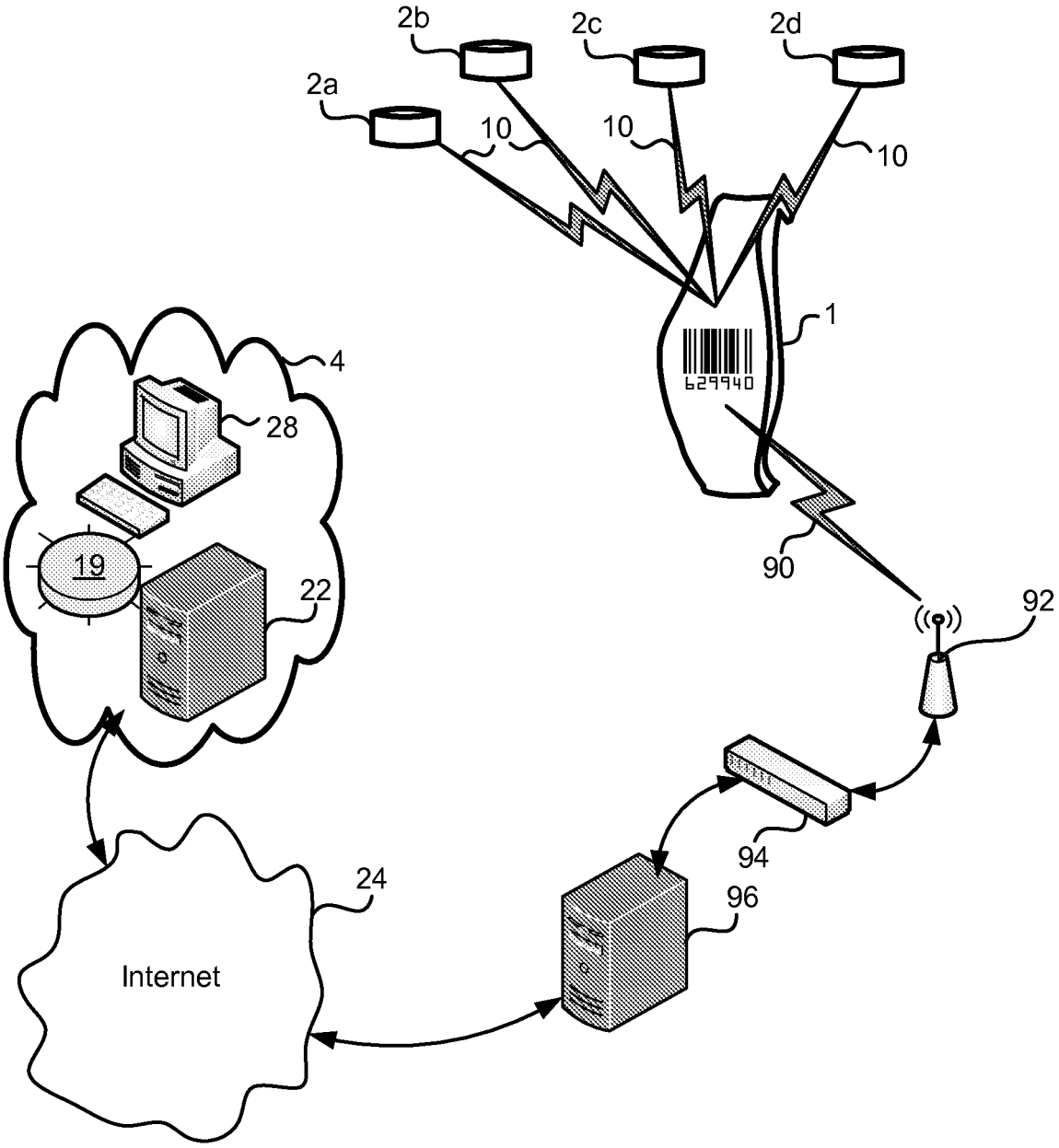

FIG. 8

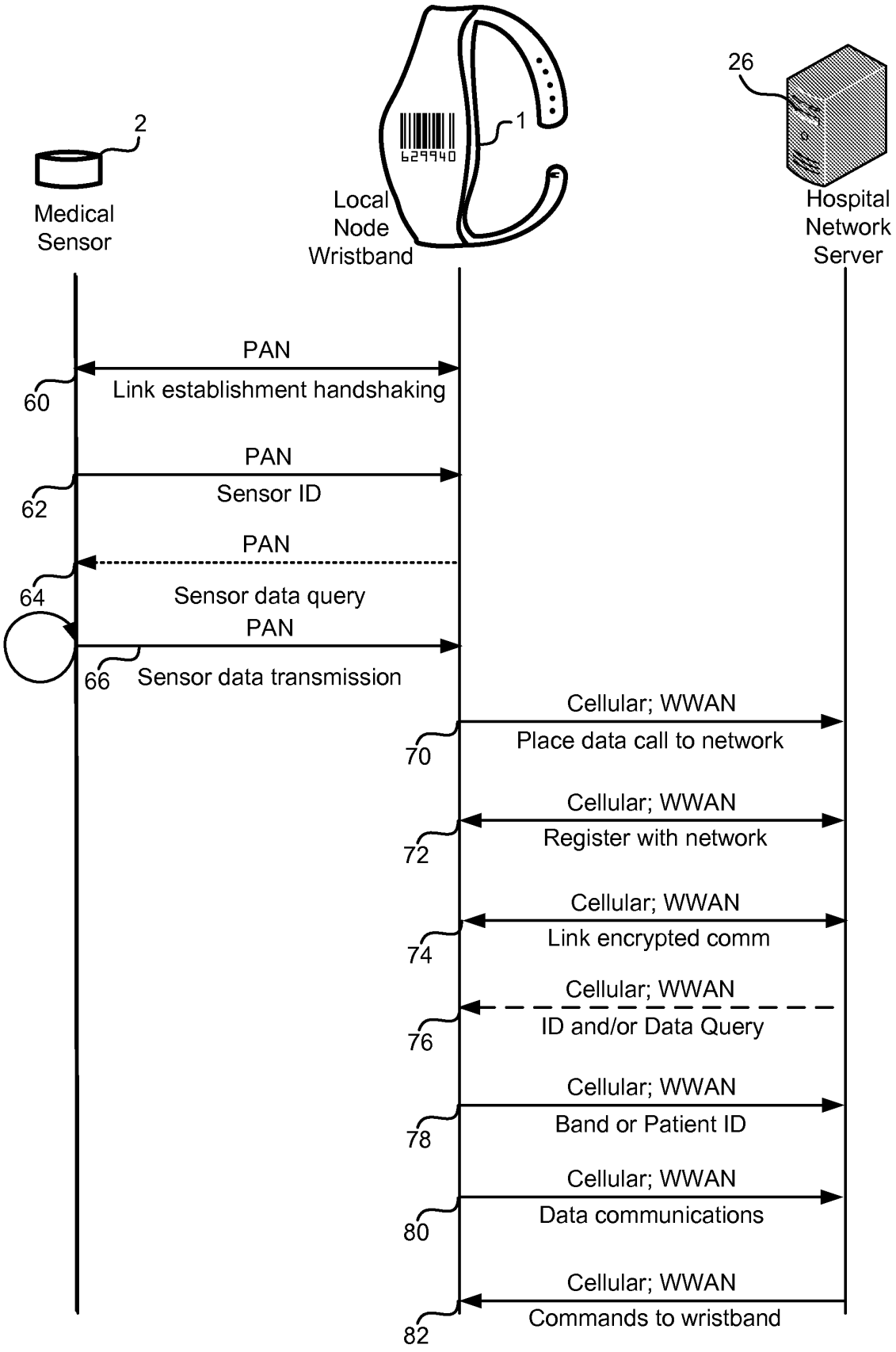
2
Medical Sensor
1
Local Node Wristband
26
Hospital Network Server
PAN
Link establishment handshaking
60
PAN
Sensor ID
62
PAN
64
Sensor data query
PAN
66
Sensor data transmission
Cellular; WWAN
Place data call to network
70
Cellular; WWAN
Register with network
72
Cellular; WWAN
Link encrypted comm
74
Cellular; WWAN
ID and/or Data Query
76
Cellular; WWAN
Band or Patient ID
78
Cellular; WWAN
Data communications
80
Cellular; WWAN
Commands to wristband
82

FIG. 9

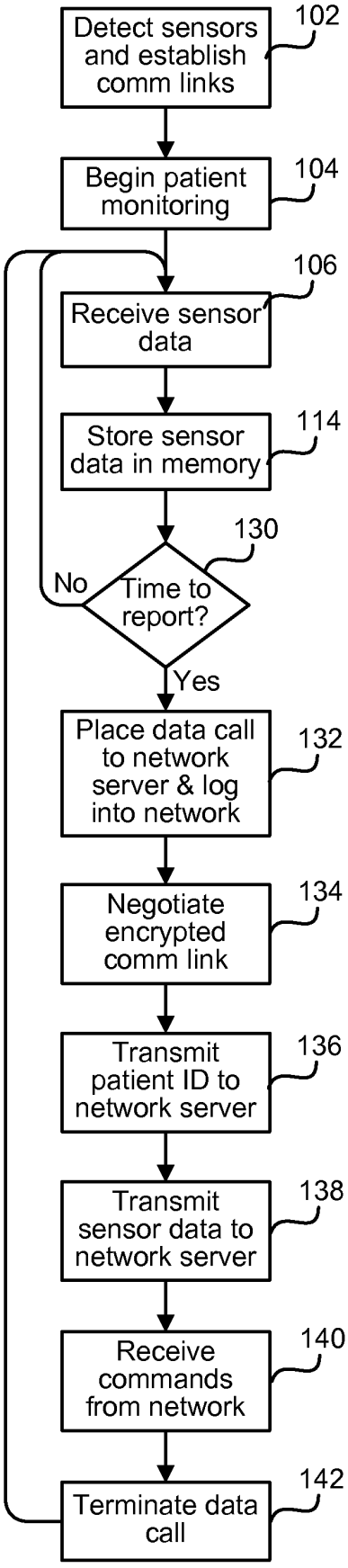
Detect sensors and establish comm links
102
Begin patient monitoring
104
Receive sensor data
106
Store sensor data in memory
114
Time to report?
130
No
Yes
Place data call to network server & log into network
132
Negotiate encrypted comm link
134
Transmit patient ID to network server
136
Transmit sensor data to network server
138
Receive commands from network
140
Terminate data call
142

FIG. 10

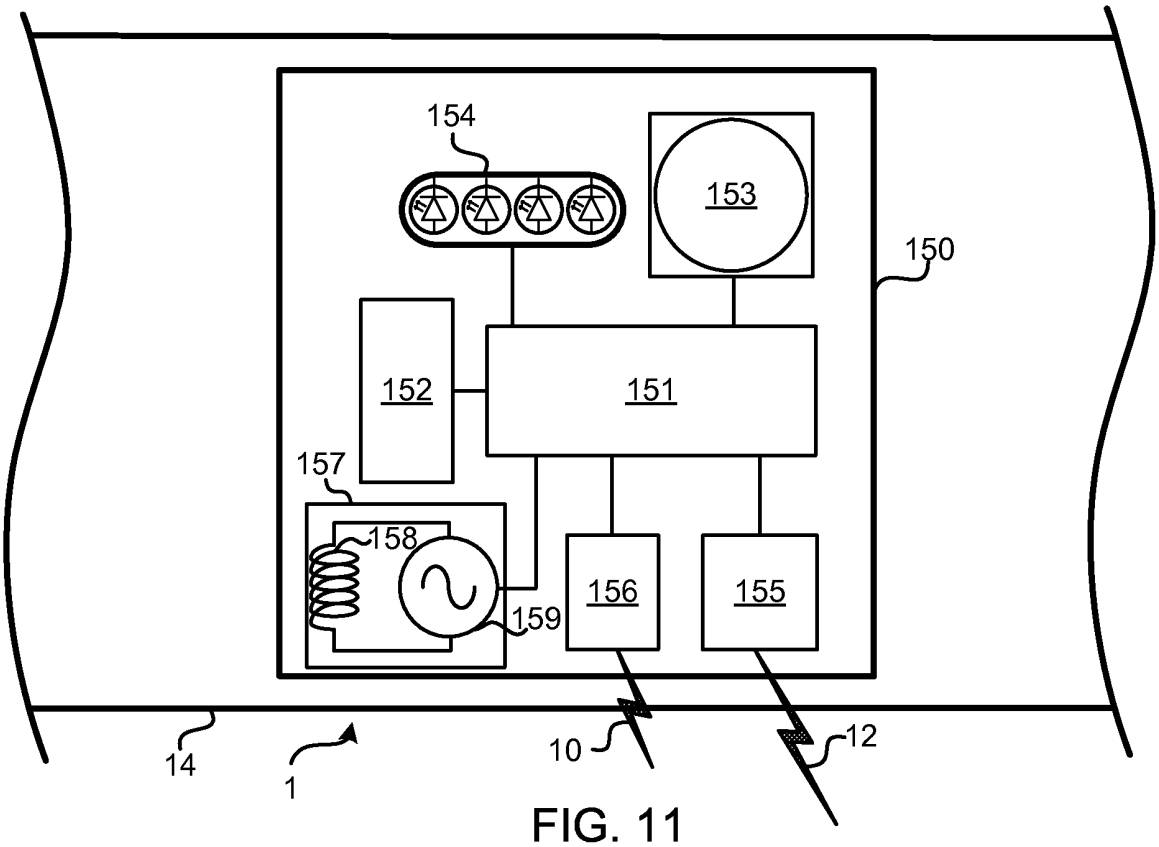
154
153
150
152
151
157
158
156
155
159
14
1
10
12

FIG. 11

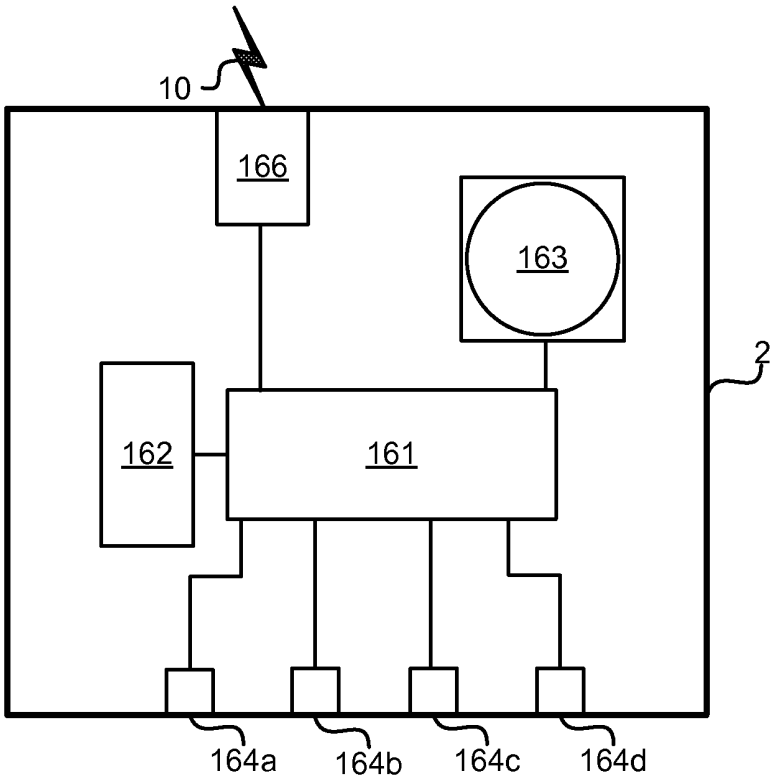
10
166
163
2
162
161
164a
164b
164c
164d

FIG. 12

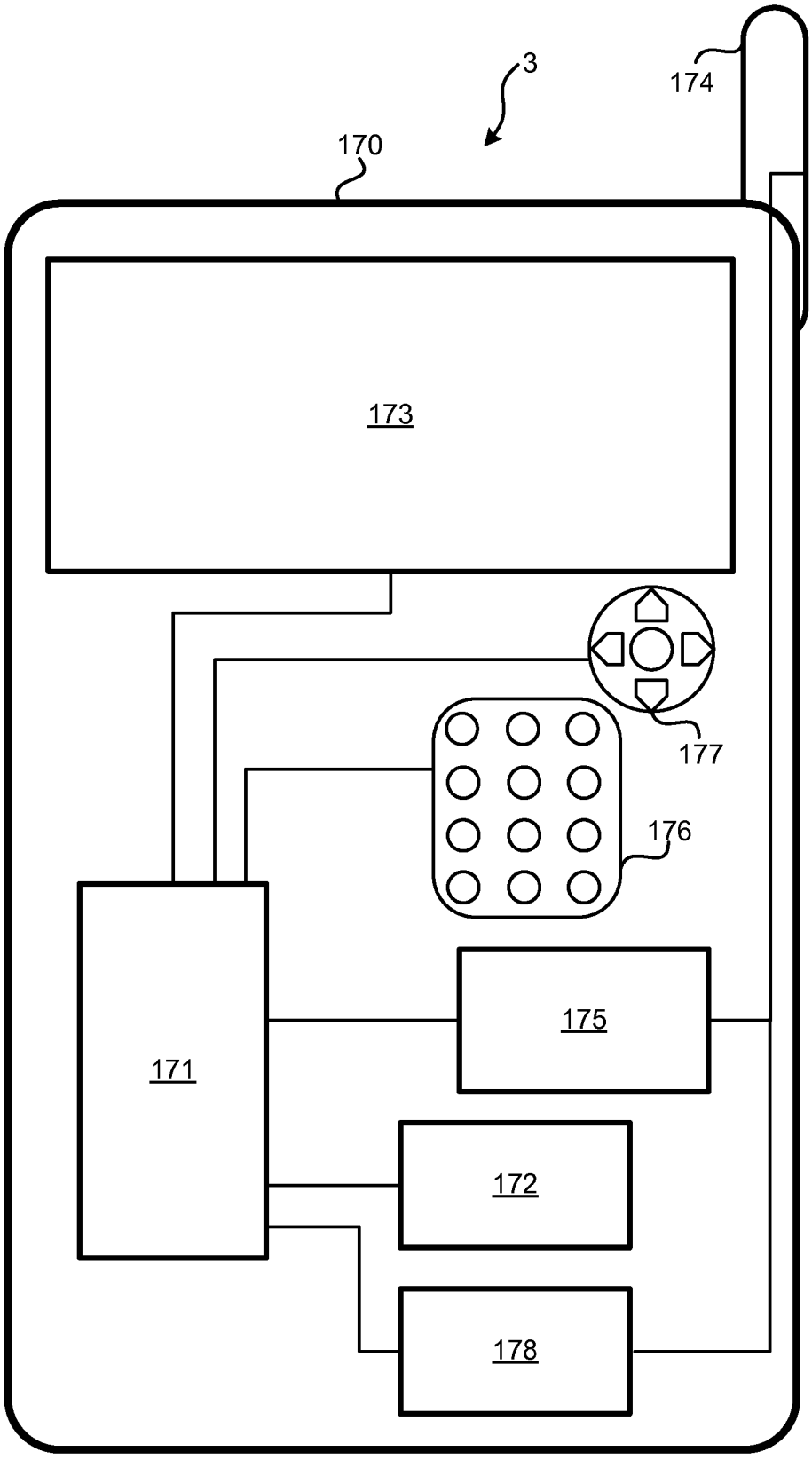

FIG. 13

REFERENCES CITED IN THE DESCRIPTION

This list of references cited by the applicant is for the reader's convenience only. It does not form part of the European patent document. Even though great care has been taken in compiling the references, errors or omissions cannot be excluded and the EPO disclaims all liability in this regard.

Patent documents cited in the description

- US 2009030967 A1 **[0004]**
- US 2006238333 A1 **[0005]**

专利名称(译)	用于医院和医疗应用的识别和连接网关腕带		
公开(公告)号	EP2441312A1	公开(公告)日	2012-04-18
申请号	EP2010725566	申请日	2010-06-10
[标]申请(专利权)人(译)	高通股份有限公司		
申请(专利权)人(译)	高通公司		
当前申请(专利权)人(译)	高通公司		
[标]发明人	TEAGUE EDWARD HARRISON		
发明人	TEAGUE, EDWARD, HARRISON		
IPC分类号	H04W88/04 A61B5/00 H04W4/38 G16H10/65 G16H40/20		
优先权	12/482175 2009-06-10 US		
其他公开文献	EP2441312B1		
外部链接	Espacenet		

摘要(译)

通信网关腕带用作患者标识的来源，并用作患者身上的小型电子医疗传感器的个人局域网（PAN）与无线广域网（WWAN）（例如医院网络）之间的接口。网关腕带包括可以与无线医疗传感器建立无线数据链路的PAN收发器，可以与WWAN基础设施建立无线数据链路的WWAN收发器，存储患者标识符的存储器以及通过PAN收发器接收数据的处理器并通过WWAN收发器将患者标识符和接收到的数据中继到外部网络。处理器管理与PAN和WWAN收发器的通信，将接收到的传感器数据存储在内存中，并将数据从PAN协议转换为WWAN协议，以便将传感器数据中继到医院基础设施。